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ABSTRACT

This document is intended to introduce health occupations educators to the principles of the portable action lab and help them use those principles to create quality learning projects for students preparing for careers in health care. Section 1 outlines the concepts and frameworks of quality project-based learning, which is based on the following core elements: authenticity; academic rigor; applied learning; active exploration; adult relationships; and assessment. The structural elements of project-based learning (group size; method for arriving at project structures and topics; duration; and integration of subjects) are discussed along with the concept of scaffolding, which is a process for building the support needed by students to complete high-quality projects. Section 2 examines the following steps in planning student projects: (1) defining a central question or concept; (2) reaching out to community members; (3) designing classroom and community activities; and (4) developing assessment mechanisms. Section 3 presents summaries and analyses of six student projects based on the principle of the action learning lab. Each project description contains the following elements: background information; implementation guidelines; and a brief analysis of the project's incorporation of the principles of quality project-based learning and scaffolding. The bibliography lists 17 recommended publications. A project analysis template is appended. (MN)

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A Portable Action Lab

for Creating Quality Student Projects for Health Care Careers

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About Jobs for the Future

Jobs for the Future (JFF) is a national, non-profit organization that conducts research, proposes policy innovations, designs systems, and provides technical assistance. Our goal is to enhance economic security and access to opportunity for all individuals by strengthening the transitions and linkages between work and learning.

JFF has been working on school-to-career transition issues since the movement began. Staff come from a variety of professional backgrounds, including teaching, education administration, private sector management, community-based work, and local and state government. As part of its flagship Benchmark Communities Initiative (BCI), JFF is working with five large school districts, and their community partners, in their efforts to build systems of school-to-career transition for all of their young people.

About the Authors

Anthony Alongi. Mr. Alongi is a Project Manager on several research and technical assistance projects at JFF, focused primarily on issues of work-based learning and employer involvement in school-to-career initiatives. He also manages local school-to-career contracts, develops workshops and products for the field, and serves on the lead design and implementation team for JFF's annual National Leadership Forum on School-to-Career Transition. He received his Master of Public Policy degree from the Kennedy School of Government at Harvard University and his Bachelor of Arts in Economics from Carleton College.

Sonia Arora. Ms. Arora, as a Project Associate at JFF, assists the Program Director in the area of state school-to-career and workforce development system building. Prior to joining JFF, she worked as an editorial assistant for *3-2-1 CONTACT*, a science/technology magazine for kids published by the Children's Television Workshop. Ms. Arora received her Master of Education degree from the Harvard Graduate School of Education and a Bachelor's in English literature and journalism from the State University of New York.

Christopher Hogan. Mr. Hogan's work as a Project Manager at JFF focuses primarily on education reform at the school, district, and state levels within the context of school-to-career system building. He is involved in the development of many school-to-career products, and serves on the lead design and implementation team for JFF's annual National Leadership Forum on School-to-Career Transition. Prior to joining JFF, Mr. Hogan helped found the School Leadership Project (SLP) of Dartmouth College and collaborated in the planning and facilitation of weekly in-service activities with participating schools. He received a Bachelor of Arts in Drama and Education from Dartmouth College.

Adria Steinberg. As Program Director of JFF's Quality Work-Based Learning Network, Adria Steinberg works with high school teams to bring real-world standards, authentic problems, and external adults into the center of instructional practice. In addition to managing this initiative and providing technical assistance to schools, she creates relevant sets of written tools, materials and exemplars. Ms. Steinberg has 30 years of experience in the field of education—as a teacher, staff and curriculum developer, writer, and, most recently, as the academic coordinator of the Rindge School of Technical Arts in Cambridge, MA. She has authored numerous publications, and, for five years, was the writer/editor of the *Harvard Education Letter*. Among her recent publications is *Real Learning, Real Work*, a book focused on project-based and work-based learning (Routledge Press, 1997). She graduated with honors from Swarthmore College and received her Masters in Education from Boston University.

Margaret Vickars is a Senior Scientist at TERC in Cambridge, MA, and Principal Investigator for TERC's Working to Learn, a series of projects which create closer links between science, technology, and work, through policy discussion and the development of integrated high school science curricula. She co-authored *Technology Education in the Classroom: Understanding the Designed World*. Dr. Vickars has worked as a consultant to JFF for many years, and was a JFF Senior Fellow in 1996-97. She holds undergraduate and master degrees in science from the University of Melbourne, and a doctorate from the Harvard Graduate School of Education.

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This Portable Action Lab builds heavily upon the work of Adria Steinberg in her book, *Real Learning, Real Work* (Routledge Press, 1997); and of Margaret Vickers and the Working to Learn project based at TERC. We gratefully acknowledge the contributions of all those who have brought those projects to fruition.

In addition, we would like to thank the practitioners at our National Health Employer School-to-Career Network sites, as well as those at Johnson & Johnson's Bridge to Employment sites, for their pioneering work in improving school-to-career transitions for students. Much of our experience in relating school-to-career transition concepts to the field of health care is due to the openness, persistence, and creativity of these people.

Finally, this Portable Action Lab, and the ideas and practices behind it, would not have been—and will not be—possible without the efforts of literally thousands of teachers, administrators, employers, community members, and students nationwide. We acknowledge and appreciate all of them for their continued commitment to increasing economic and educational opportunities for young people.

About This Portable Action Lab

What Is a "Portable" Action Lab?

Quality project-based learning has been introduced by JFF staff and consultants to thousands of teachers and community partners over the past few years, through local workshops, specialized retreats, and national conferences. These staff members and consultants, veteran teachers themselves, have practiced what they preach. They have seen for themselves the power of this pedagogy to engage students more actively in learning.

JFF often uses the term "action lab" to describe one type of workshop we do. An action lab departs from many professional development opportunities in that its primary goal is to give practitioners the structured time to explore their own projects and initiatives and generate something concrete for follow-up action. Action labs can be about curriculum development, alternative assessment, strategic planning, or anything that relates to the actual work that practitioners do once the training is over. Some action labs entail a series of workshops that provide critical follow-up training for teachers who wish to refine and improve their work on an ongoing basis.

In this work, JFF has distilled the principles used in one of its more frequent action labs—creating quality integrated projects—and adapted it for use in health care careers. We have no illusions about what a guide like this can and cannot do. Peer learning sessions and facilitated workshops provide extemporaneous and motivating exchanges of ideas that are difficult, if not impossible, for printed media to replicate. Still more critical are follow-up learning opportunities that give participants the chance to refine their understanding, revise their efforts, and maintain momentum for reform. Our intent with a product like this is to make the principles we advocate, and the best practice innovations we admire, more accessible to a wider set of teachers and communities. That in turn will help inform the peer learning sessions and workshops that are essential to a sustained, quality professional development effort. In other words, we want to make our knowledge and expertise, and that of our friends across the country, more "portable" so that each practitioner can adapt it for his or her own use.

We hope that this guide will serve as an inspiration, a planning tool, and a "reality check" for teachers and community partners who wish to undertake or evaluate their own efforts. The labor of educators is precious to our society. We cannot bottle it, but we can describe what we see and hear from some of the best in the business. It is in that spirit that we offer this resource to you.

The Connection with Health Care Careers

Although quality project-based learning can occur within many academic and professional fields of study, this Portable Action Lab has a health care careers focus (including both services and manufacturing), for two reasons. First, we are responding to an expressed need for instructional tools that could be used to raise the quality of integrated projects used in Johnson & Johnson's Bridge to Employment sites. Second, health care is an omnipresent industry. Every community has a hospital or health care center. Many have manufacturers of medical supplies, or health insurers, or any one of a number of "satellite" employers that fall within this broad industry cluster. Quality project-based learning can happen with virtually any kind of community partner; but, for these reasons, health care seemed a good place to start.

The health care industry—representing some of the most active and experienced employers in the school-to-career movement—has been undergoing significant changes nationwide. First, skyrocketing medical care costs have forced many hospitals and health care

centers (particularly those in urban areas) to restructure, merge, and even shut down. Second, the rapid rate of technology growth has opened up growth and employment opportunities in industries that did not exist a decade ago—and in firms that did not exist as recently as a few years ago. Third, an explosion of new occupations, due to advances in biochemistry, high-tech manufacturing, and genetic engineering, has found many employers seeking labor that is both *deeply* skilled enough to do rigorous analytic and technical work, and *broadly* skilled enough to succeed in a rapidly changing environment.

The implications of these changes for education are twofold. First, employers' needs for multi-skilled workers—well-rounded employees who have both basic skills and "employability" skills (e.g., the ability to work in teams)—has never been greater. Second, the integration of rigorous academic content—especially the natural sciences, and mathematics—into health care school-to-career initiatives is absolutely critical, given the base of knowledge required even for entry-level jobs in health care. Watered-down academics do no student any good. Health care industry representatives must hold all students to high standards, and engage academic teachers as broadly as they do the teachers of technical and occupational courses.

How to Use This Portable Action Lab

The first section, "Concepts and Frameworks," explains the general concepts behind quality project-based learning, and provides three concise frameworks for structuring and evaluating project-based experiences. The second section, "Planning your Own Project: Common Threads," gives a brief sketch of the process many practitioners use to create quality project-based learning experiences. We have incorporated interviews and observations from past months and years with teachers, students, and community members. These stories of success all have certain common elements that we have distilled for you; we hope you find them helpful in establishing your own new learning experiences for students. The "Project Summaries" then provide glimpses into six projects that have been implemented in real settings. A Project Analysis is performed for each of the six projects, so that you can see how you might use the frameworks to think through your own project(s). Each of these project summaries has, where available, information on how to get more detailed descriptions or a full curriculum.

> "What really helps me is being exposed to new ideas that I can apply to my own subject areas. If that is stealing, then I am a great thief."
>
> —*Teacher*

Finally, we have included a list of sources used in the creation of the Portable Action Lab, as well as recommendations for further reading and exploration. We have found each of these sources to be intellectually and spiritually compelling in their focus on how to help students succeed as they transition out of the school world, and into their own.

The Appendix contains a blank "Project Analysis" template which you can use to assess quickly quality in projects.

I. Quality Project-Based Learning: Concepts and Frameworks

Across the country, students are engaged in a new kind of active learning...

Oakland, California. Physiology students in the eleventh grade begin their school year by interviewing relatives to develop detailed family medical histories. Over the fall, small teams choose an interesting health problem or issue, develop a proposal for exploration, maintain research notebooks and lists of sources, and work under the tutelage of an industry coach. Each team then begins work on a substantial newsletter containing factual pieces on the health issue, articles detailing related controversies, and relevant human interest stories. Finally, with coaching from professionals, students turn their knowledge on the issue into a health education seminar, which they deliver to a group they believe with benefit from the information.[1]

East Boston, Massachusetts. A neighborhood health center employs teams of high school seniors as consultants to study methods of improving the health of local teenagers. The students—using time and support from English, Anatomy & Physiology, and Health Professions classes as well as work hours at the center—conduct a survey of local youth and research different models of health care delivery. A local nonprofit agency acts as an intermediary, connecting students with community professionals who can share expertise on key skills. Based on their research, students develop presentations that they deliver to the health center's board.[2]

> "I was starting my 17th year of teaching and I was trying to find some joy in doing the same subject over again. I knew that I could not stand up in front of the room and tell my students what they should learn anymore...When I started [quality project-based learning] I thought that I had gotten myself in to just another fad...Then something happened, I tried it in the classroom and it worked. It was a lot of work, but it felt good to be teaching like I was supposed to. I was excited to go to work again and I found myself looking forward to going to class. This is the second year and I wouldn't want to ever go back to the lecture format. Not after watching the students excel in the new format of self-directed learning."
>
> —*Teacher*

The stories above—actual experiences of students in public schools—represent a new way of learning that teachers at many American schools are beginning to embrace. **Quality project-based learning** seeks to blend authentic, real-world experiences with rigorous academic study so that students can practice and demonstrate skills that will serve them well in college, career, and life. It advances the notion of what a "project" can accomplish, emphasizing connections between classroom and community.

Quality project-based learning is a pedagogy quite compatible with, and receiving considereble momentum from, two current movements in education reform—the school-to-career (STC) movement and the standards movement. Now in its fourth year of federal support, the STC movement has matured to the point where practitioners across the country have developed relatively sophisticated work-based learning programs, often (but not always) based on pre-existing "co-op," "Tech Prep," apprenticeship, or other work-and-learning models.[3] In addition, many districts and schools have begun to implement structural changes—block scheduling, course clustering, targeted professional development

[1] Excerpted from Steinberg 1997b.

[2] Excerpted from *The Harvard Education Letter*, March/April 1997.

[3] "School-to-career" and "school-to-work" are terms that both describe the same movement. "School-to-career" will be used throughout this document, given its clearer focus on creating wider educational and economic opportunities for students upon graduation from high school. For more detail on school-to-career, the School To Work Opportunities Act and its components, the reader can reference the federal government's School to Work Opportunities Information Center, 330 C Street Southwest, Washington, DC, 20202-7100. Tel: (202) 401-6222, www.stw.ed.gov.

activities, special staffing—that aim to support STC's goals for students. These changes are exciting, and are beginning to bear fruit as the first cohorts of students in exemplary programs graduate high school and enroll in college in impressive numbers.

Despite these gains, virtually every local practitioner in the STC movement has struggled in attempting to connect what happens within a classroom to what happens beyond a classroom. As one teacher said, "We're stuck at a point where students shuttle back and forth, between school and worksite, never figuring out what the two have to do with each other." This often translates into little change in academic performance by students, which puts continuing support for school-to-career pedagogy at risk.

One of the most promising approaches to be adopted, and one that JFF has worked extensively to disseminate among practitioners, is the use of projects that integrate rigorous academic material with practical knowledge students garner from real-world experiences—at private sector worksites, in community settings, or even within school buildings themselves. These projects go beyond traditional notions of what a "project" is.[4] They engage students in active learning, involve adults from beyond the classroom as coaches, and emphasize authentic assessment methods. They usually cross disciplines in a messy way, like the world outside of school often does. And they employ strategies like teamwork, reflection, and continual assessment that are not typically encouraged in the traditional classroom.

The philosophy of quality project-based learning does not find support in the STC movement alone. Across the country, more and more districts and states are seeing that achieving high academic standards for all students requires innovative pedagogical approaches and strategies. The burgeoning standards movement provides schools, teachers, and their partners with opportunities to rethink not just the *goals* of education, but the *means* as well. For example, in many schools, interdisciplinary teams of teachers—with the help of community employers—are forging projects that are explicitly tied to new state or district standards. Teachers, seeking instructional approaches to help students meet those new standards, view the development of their own skills in project-based learning as part of the solution. Quality project-based learning generates enthusiasm, rather than cynicism, because *it's not just another "program," but a solution to an identified problem.*[5]

> "I have what I call the 'sweat test'. If you're not sweating, it's not working. That applies to adults and students alike."
>
> —*Community Partner*

Quality project-based learning is about rigor and relevance. It makes no compromises on what students must achieve, nor on how accessible and engaging the learning must be for them. It has been tested in classrooms and communities and has generated powerful stories of success. Finally, it provides teachers with opportunities to elevate their own learning and skills.

Structural Elements

While good learning experiences bear several common components, there is not just one "right" structure for quality project-based learning. There is a great deal of variety among good projects, as you will see in the samples included in this guide. Some of the ways in which projects may vary include the following **four structural elements**, or **"dimensions,"** of quality project-based learning:[6]

[4] Each of us can probably cite examples from our own education when we were asked to build a model, take part in a business simulation, or complete some other project for a class. In many cases, the word "project" is used to describe any student work that goes beyond reading, completing worksheets, writing reports, and taking tests. While the instructional use of small-scale, hands-on learning activities is certainly beneficial, such activities are not "quality project-based learning" as JFF defines it.

[5] For a more extended discussion of how school-to-career pedagogy contributes to the implementation of standards, see Vickers 1997.

[6] "Dimensions of Quality Project-Based Learning" were first developed by Margaret Vickers and the Working to Learn Project at TERC. The dimensions were adapted and extended for this guide.

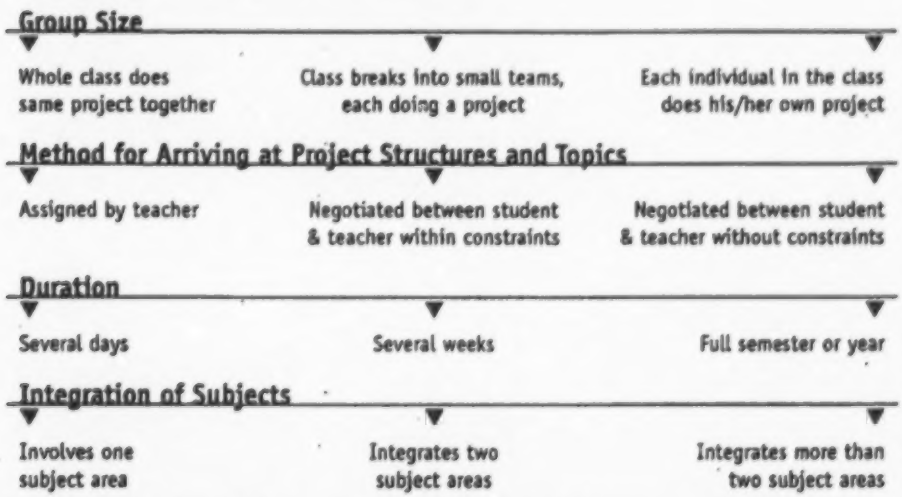
1. Group Size: A project can be done by an entire class at once, with the topic either decided upon by the whole class or provided by the teacher. In this case, the class might break into "teams" that serve different functions; but the project remains "whole class" since all teams' efforts are harnessed to the same project goal. At the other extreme, each individual in the class can pursue their own independent topic, which may or may not have anything to do with what another student is doing. This generally requires the teacher to cover a much broader range of topics and provide a wider pool of resources. Between these two options are project teams that can be of any size, each pursuing a different project. The teams may all be doing something similar (e.g., all working with the same hospital, but in different departments); or they may be quite independent entities (e.g., one team working on clinical care, while another works on health care policy issues).

2. Method for Arriving at Project Structures and Topics: Teachers can be prescriptive about the subject matter that student will pursue; or they can set some boundaries around what students may pick for a topic and scope; or they can let students set their own agendas completely. The point chosen on this spectrum can vary depending on the age and maturity of the students in question, and depending on the need of the teacher (or community partners) to address particular concepts or topics.

3. Duration: Projects can last several days, a few weeks, or an entire semester (or year).

4. Integration of subjects: This dimension can refer both to the *implicit* sense of integration (where a project taught in a science course also has elements of history and language, but is still taught completely within the science class); and to the *explicit* sense of integration (where a project is team-taught or coordinated across classes by teachers from the various disciplines). A project can be set entirely within one discipline for the sake of focused student learning; or it can support exploration of the messy intersections between two or more disciplines.

Each dimension can be represented as a spectrum:


Group Size
Whole class does same project together
Class breaks into small teams, each doing a project
Each individual in the class does his/her own project
Method for Arriving at Project Structures and Topics
Assigned by teacher
Negotiated between student & teacher within constraints
Negotiated between student & teacher without constraints
Duration
Several days
Several weeks
Full semester or year
Integration of Subjects
Involves one subject area
Integrates two subject areas
Integrates more than two subject areas

The complexity of project design and implementation tends to increase on each dimension the further to the "right" you go. However, there are no qualitative judgments assigned to these dimensions. Having individual students working on separate projects is not necessarily better than having small groups working as teams; and a good project in one subject area can be as rich a learning experience as a project that integrates three. The one possible exception is the dimension of duration: typically, longer projects allow for deeper exploration of a topic, more meaningful relationships with adult coaches, and more chances for ongoing assessment. And projects that last less than several days would have a hard time meeting the quality criteria established below.

> "I am very surprised I am saying this, but I actually had fun doing this type of project... I not only learned more about my family history, but about our own American history."
>
> —*Student*

The dimensions are largely independent of each other: greater complexity in one dimension does not necessarily increase the complexity of the other three. For instance, a project might involve small groups working on topics assigned by the teacher; it might also last a whole semester and integrate two academic subjects.

> "These projects blew me away! I finally realized what an integrated, real-life project is like...I felt my colleagues and I found a real situation for which the students could become engrossed."
>
> —*Teacher*

These structural dimensions frame basic design questions that should be asked regardless of the content of the project; the answers determine a project's scope and quantitative factors. To examine the depth and qualitative factors of the project, a different framework is needed.

Essential Elements

What makes a "quality" project-based learning experience? A list of essential elements, dubbed "The Six A's" here, explain JFF's concept of quality project-based learning. These principles are the non-negotiables of quality project-based learning, and the goal of project design is to achieve each to the highest degree possible. The Six A's, taken together, provide a ready and easily understandable language to use in planning and evaluating projects.[7]

The Six A's of Quality Project-Based Learning

1. **Authenticity.** Projects use a real world context (e.g., community and workplace problems) to teach academic and professional disciplines.
2. **Academic Rigor.** Projects involve students in using methods of inquiry central to academic and professional discipline(s), and require higher-order thinking skills.
3. **Applied Learning.** Projects engage students in solving semi-structured problems calling for competencies expected in high-performance work organizations (e.g., teamwork, problem-solving, communication).
4. **Active Exploration.** Projects extend beyond the classroom and connect to work internships, field-based investigations, and community explorations.
5. **Adult Relationships.** Projects provide students with adult mentors and coaches from the wider community.
6. **Assessment.** Projects involve students in regular exhibitions and assessments of their work in light of personal, school, and real-world standards of performance.

> "I have learned that project-based learning is time intensive and labor intensive. But I wouldn't want to teach any other way....I see my students digging deeper for the information they want. I see them not being satisfied with just asking questions—they really want to know the answer. I see growth in the work they turn in; there is a sense of pride that they didn't have at the beginning of the year. I see my students turning in quality projects that go beyond the requirements. I have one student that failed the class last year, but this year she is getting an A."
>
> —*Teacher.*

When designing or refining projects, teachers can ask themselves several critical questions related to these elements. This reflection process can lead to possible enhancements of missing elements.

[7] Adapted from *The Harvard Education Letter*, March/April 1997. See also Steinberg 1997b.

Authenticity	Does the project emanate from a problem or question that has meaning to the student?
	Is it a problem or question that might actually be tackled by an adult at work or in the community?
	Do students create or produce something that has personal and/or social value, beyond the school setting?
Academic Rigor	Does the project lead students to acquire and apply knowledge central to one or more discipline or content area?
	Does it challenge students to use methods of inquiry central to one or more discipline? (e.g., to think like a scientist)
	Do students develop higher order thinking skills and habits of mind? (e.g., searching for evidence, taking different perspectives)
Applied Learning	Are students solving a semi-structured problem (e.g., designing a product, improving a system, or organizing an event) that is grounded in a context of life and work beyond the school walls?
	Does the project lead students to acquire and use competencies expected in high performance work organizations (teamwork, problem-solving)?
	Does the work require students to develop organizational and self-management skills?
Active Exploration	Do students spend significant amounts of time doing field-based work?
	Does the project require students to engage in real investigation, using a variety of methods, media, and sources?
	Are students expected to communicate what they are learning through presentations?
Adult Relationships	Do students meet and observe adults with relevant expertise and experience?
	Do students have an opportunity to work closely with at least one adult?
	Do adults collaborate on the design and assessment of student work?
Assessment	Do students reflect regularly on their learning, using clear project criteria that they have helped to set?
	Do adults from outside the classroom help students develop a sense of the real world standards for this type of work?
	Will there be opportunities for regular assessment of student work through a range of methods, including exhibitions and portfolios?

Scaffolding

After examining a project using the Six A's, it is useful to begin "scaffolding." Scaffolding is a process for building the support that students need to complete high-quality projects. After all, most high school students are not used to doing these kinds of projects in the classroom. To help them reach high standards in their work, teachers have to achieve a balance between too much and too little structure. If completing a project is thought of as building a tower, the students should act as the builders. The role of teachers, coaches, mentors and other adults is to provide the scaffolding that allows the students to take their work to a higher level.

"The project structure was good for me. I liked having freedom to use facilities, time, and people I needed."
—*Student*

Below is a three-part framework that teachers can use in assessing whether there is enough scaffolding to support students as they do high quality work.

1. Explicit Expectations and Criteria. Students are given clear guidelines from which they can plan their projects. They should know exactly how and when their work will be evaluated, and ideally should be involved in the establishment of the criteria for that evaluation. Guidelines for projects differ from instructions. Rather than telling students exactly what to do, guidelines provide a process by which students can plan and execute their projects. Key questions:

- Are there clear guidelines for students to use in planning their project work?
- Do students know how and when their work will be assessed?
- Were students involved in the establishment of criteria for the assessment?

"I know from doing projects myself, you're not hitting every academic note. It's only after you've done a project two or three times do you see more effective ways... Teachers will see the quality of their work improve as they continue to implement more projects in their classroom."
—*Teacher*

2. Access to Essential Resources. Teachers guide students by pointing them toward useful materials. These brokered resources go well beyond traditional information sources such as books and articles. They might include exemplars of other projects for students to use as models; coaches and mentors who can support a field investigation; technology necessary for carrying out the project; and so on. Key questions:

- Are students given the opportunity to review exemplars of work other students have done on similar projects?
- Do students have a mentor or coach to support the field-based elements of the project?
- Do students know how to use and have access to the technology necessary to both the research and exhibition phases of the project?

"It is important to show the work to the public. In the process, teachers and students will see how they can elevate their work to the next level."
—*Teacher*

3. Milestones, Ongoing Assessment, and Continuous Feedback. Ongoing assessment gives students the information they need to complete a project that meets expectations in the given schedule. While teachers may provide much of this feedback, students should also receive feedback on their works in progress from coaches, mentors, and peers. Students should also engage in periodic, structured self-assessment of their progress. More points of assessment, from a greater variety of sources, create richer final products.

Establishing "milestones" can be useful in creating a framework for ongoing assessment, by requiring a number of deliverables throughout the period of the project rather than just one final product at the end. Milestones have three benefits. First, they create check-in points for students to make sure their project is on the right track. Next, milestones help reduce a large complex job into smaller, more manageable tasks. Finally, they make school work look more like real work in that projects on the job typically involve a number of discrete pieces. Key questions:

- Are there check-in points at the completion of each distinct phase of the work?
- Are students expected to turn in a series of "deliverables" prior to the final product?
- Do students engage in periodic, structured self-assessment of their progress?
- Do they receive timely feedback on their works-in-progress from teacher, mentor, and peers?

II. Planning Your Own Project: Common Threads

This Portable Action Lab so far has assumed that readers have projects of their own that they've worked with, possibly for years. We have provided frameworks for assessing and pushing the quality of those projects even further. Before we apply those frameworks to sample projects, we want to discuss a bit more the process of conceptualizing, designing, and implementing quality projects. This section was written with the notion that some readers—teachers and their community partners—will be starting "from scratch." We draw from the experiences and advice of teachers and employers with years of experience generating quality project-based learning experiences for young people, particularly in health care careers. Within their stories lie certain "common experiences" that, when put in a sort of sequence, provide a rough road map that may prove useful in launching something new.

Four Common Steps, Two Different Staircases

There are four broad steps involved in creating a quality project-based learning experience: establishing a *central concept;* connecting with the *community;* deriving student *learning activities* within and beyond the classroom; and developing *assessment* mechanisms. (A fifth step, *refining* the project based on actual implementation, is the focus of the other sections.)

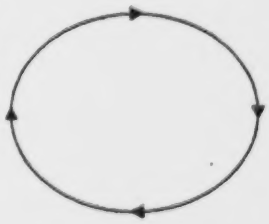
Teachers generally accomplish these steps using one of two approaches. Both can work well, and very few teachers use only one method exclusively. The first, called here the *scientific approach,* is similar to the scientific method because it accomplishes the above steps in an ordered sequence, starting with the generation of a central question (or concept). The question is refined in light of local or state academic standards and industry skill standards, until it seems rigorous and relevant enough. A visit to a worksite or community setting helps establish key connections between academic and skill standards. After that, activities for the classroom and worksite(s) are determined. Finally, an appropriate assessment is designed that builds from the activities, and demonstrates a student's full grasp of the question (and the standards behind it). The implementation of the project follows, and results are used to refine the project for next time (or to generate new projects). Thus the circle is completed, in a logical order.

Scientific Approach to Project Generation

A central question forms the core of a sequential process that develops and refines the project in a "logical" order.

1. START. Teacher(s) or community partner(s) generate central question from workplace needs or academic standards.

2. Teacher(s) and community partner(s) review relevant academic and skill standards together, and refine the question.



3. Teacher(s) and community partner(s) generate activities for within and beyond the classroom.

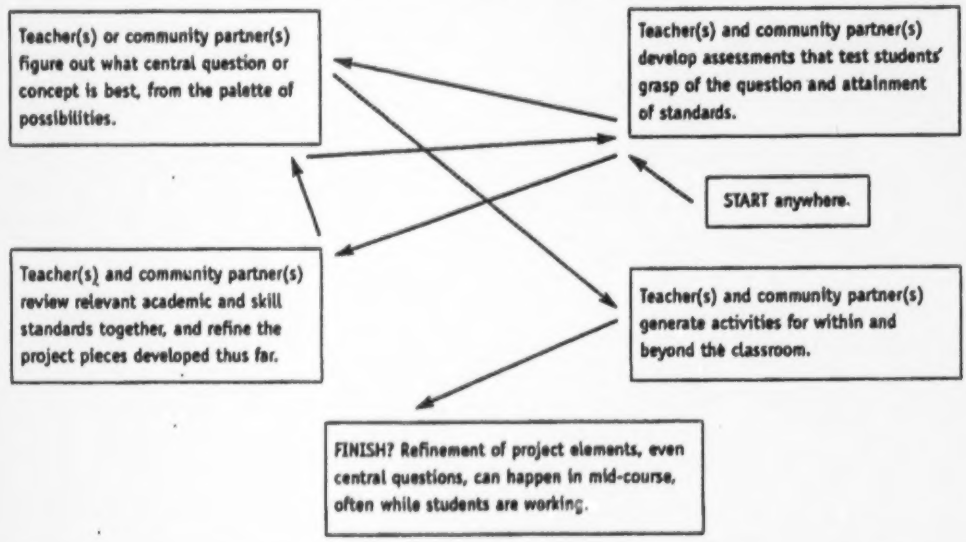
4. Teacher(s) and community partner(s) develop assessments that test students' grasp of the question and attainment of standards.

5. FINISH. Once project is implemented with students, teacher(s) and community partner(s) use "findings" to refine elements of project, or generate new projects.

Many other teachers create their projects through what is called here the *artistic approach*. This method, much like the way an artist approaches a new painting, often starts with a "raw image" of students doing something wonderful and new. It may be a fragment of an activity already in existence that then builds into an idea for a new performance assessment (or maybe a product students will create), which in turn generates a notion for a totally different central academic concept or question that students should address. In other words, it gets to all the same places as the scientific approach, but might start anywhere, and follows a "random" path until the job is done.

Artistic Approach to Project Generation

The "raw image" starts anywhere, and is refined through any one of a number of sequences.
(The sequence used here is only one possibility.)


Teacher(s) or community partner(s) figure out what central question or concept is best, from the palette of possibilities.
Teacher(s) and community partner(s) develop assessments that test students' grasp of the question and attainment of standards.
START anywhere.
Teacher(s) and community partner(s) review relevant academic and skill standards together, and refine the project pieces developed thus far.
Teacher(s) and community partner(s) generate activities for within and beyond the classroom.
FINISH? Refinement of project elements, even central questions, can happen in mid-course, often while students are working.

One approach is obviously not better than another. Many teachers and community members might prefer the artistic approach. It provides flexibility and can be "friendlier" to work within, particularly if you are new to the whole concept of project-based learning. Some teachers working in the sciences, and many scientists themselves (as well as other professionals who regularly test hypotheses, such as detectives), might like the sequential method of the scientific approach. It forces discipline and keeps all the bases covered.

Many projects are not simple enough to approach either way, exclusively. Patricia Clark, a teacher at the Oakland Health Science Academy, uses more than one question to structure her projects. She sees project design like a multi-layered web page that requires different questions at various stages. She often begins with a more artistic approach—an image flashing in her mind of something creative she'd like students to do—and then breaks the "whole picture" image into chunks that she can sequence. Then, she returns artistically again to points here and there to refine them. This mixed approach is the one that will probably seem familiar to most readers.

Project ideas, then, will come from different sources, and the projects themselves will develop in different ways. However, at some point a central theme will arise, and at that point there should be two principles that drive that theme: *striving for high academic standards* and *creating a relevant context for students*. It is no accident that these drivers relate to two of the Six A's: academic rigor and authenticity.

By focusing deeply on several key standards, projects enable teachers to explore the depth of a concept with students, and encourage the development of higher order thinking skills. Many existing standards frameworks, such as the *National Science Education Standards* (National Research Council 1996), are compatible with this approach. They urge teachers to focus on in-depth learning of a limited number of powerful concepts, emphasizing understanding, reasoning, and problem solving, rather than memorization of facts, terminology and algorithms. By consulting this and other sources, such as *Performance Standards: Volume 3, High School* (National Center on Education and the Economy 1997), teachers can craft rigorous projects that demand a diverse repertoire of skills from students.

Authenticity plays a role equal to that of academic standards. Quality projects seek ways to engender curiosity and the pursuit of critical inquiry among students early on in a given unit, not at the end as an afterthought. Over a two-year period, Margaret Vickers worked with teachers at the Fenway Middle College High School, and with the staff of the Children's Hospital in Boston, to produce a curriculum unit that addressed the essential question, "How do you know if something is wrong with your heart?" This unit opens up with activities that introduce the topic, but immediately afterward, students visit the hospital's Cardiac Pathology department for a day. In meeting with medical staff and technicians, they find out about some of the diseases that cause a heart to fail. Later on in the unit, students return and visit with experts in electrocardiography, who help them set up simulated diagnostic tests, readings, and assessments.

Ann Marie John, a Health Sciences teacher at Brighton High School, usually has standards and curriculum in mind before she plunges into a new project. While teaching how medicine was developed in the 16th century, she decided to ask her students to research the history of their own family remedies. She wanted to teach her students that medicine is not "far-removed"; it is something that is practiced at home, not just in hospitals. And she wanted to emphasize that understanding science and medicine is not just important for doctors, but for everyone.

> "The patient's defect was a ventricular septal defect with an aortic regurgitation. In layman terms, the patient had a hole in his septum in between the two ventricles of the heart, with a backward flow of blood through a defected aortic valve....I was overwhelmed by the instruments and lights. I took a deep breath and stepped forward to look into the child's chest, and stared at the most fascinating and beautiful thing, to see a human heart, the center of life itself. It is something I will never forget."
>
> —*Student*

For the purposes of narrative flow, the following sections are ordered to describe the steps of project generation using the scientific approach. (But in deference to those who prefer the artistic approach, the steps themselves are not ordered, and the sections can be read in whatever order the reader prefers!)

Defining a Central Question or Concept

At the locus of the whirl of academic standards and the skills and knowledge that the world beyond the classroom uses every day, lies a set of themes and questions that will engage students. Every teacher has the creativity to find and exploit those ideas. The teacher harnesses the power of a raw idea, and works with her partners to shape it in a way that makes it accessible to her students. That shaping is what defining a central question is about.

Once an idea has been generated, it must be shaped into a stream of exploration that students will want to navigate and which will take them somewhere. If a teacher decides to use the scientific approach, a good question can jump-start this process; it can excite students to think critically and pursue answers to questions, especially those that are relevant to their lives.

TERC's Working to Learn team defines an "essential" question as meeting three key criteria: (1) it is interesting to students; (2) it is something that someone beyond the classroom would

ask; and (3) it relates to agreed-upon academic standards. Scott Eddleman, a teacher and member of the Working to Learn team, provides this example to illustrate how the three criteria work:

Essential question:	How can DNA samples tell you about a person's health or whether someone committed a crime?
Interest to Students:	Discussing personal health issues and solving crimes are two tasks that will spark most students' interest.
World beyond the Classroom:	Technicians in genetic testing laboratories, forensic professionals, and a wide range of health and law enforcement occupations have an interest in one or both tasks.
Academic Standards:	One standard from the National Science Education Standards states, "All students should develop an understanding of the molecular basis of heredity." Most states and/or districts are developing similar standards in the life sciences.

Whether a project uses one question or several closely related ones, teachers can either generate central questions in advance (with other teachers or community partners) or facilitate this brainstorming among their students during class time. Some questions that might help teachers, partners, and students to pursue this mode of inquiry include: What things would you like to change in your community? Could your experience at a workplace help you to design or create something the community needs? Is there an issue that has special, personal meaning for you that you think you could address through a project at a workplace?[8]

> "We used to have teachers over here about once every couple of weeks. Then after a year or so, it tapered off. I think both sides miss that. We need those connections between work and school."
>
> —*Hospital Staff*

At East Boston High School, teachers and professionals from a neighboring health care center identified a question for students to explore that had special meaning to the center, and to the students themselves: What could be done to improve the health of teenagers in East Boston?[9]

The teachers at Brighton High School in Boston, working on a community garden based on school grounds, also came up with several engaging questions for their project: How does the physical atmosphere at school impact the attitudes of students? Why do some plants thrive in the Brighton garden? How can we demonstrate the water cycle? What kind of skills do we need to make a garden grow? Why do we need plants to survive? These questions determined an interdisciplinary sequence to the project that allowed the students to explore various aspects of different subjects in a real and accessible way.

Reaching Out to Community Members

Teachers need time to immerse themselves in different community settings so they can make the connections between their classroom and the world beyond. They can do this through summer externships, or shorter (one- or two-day) visits. In addition, teachers and workplace supervisors should spend some time (ideally toward the end of the externship or visit) working together to identify key learning concepts embedded in work-based activities.

One way to take advantage of limited time during such visits is for the teacher(s) to write down what they have learned from this experience, develop a series of classroom activities that would make this knowledge accessible to students, and let the workplace personnel

[8] See Northwest Regional Education Laboratories 1996.

[9] For more detail on the project from East Boston High, see later in this Portable Action Lab.

review the proposed activities. If a community partner has more time, he or she can work with the teacher to plan more specifically how classroom and workplace activities can be coordinated.

When the curriculum writers in TERC's Working to Learn project were developing units, they were very aware of the time pressures facing employers and supervisors who are trying to help educate and mentor students. After discussing the idea with several workplace representatives from different communities, the Working to Learn team decided to collaborate with these partners and write guidelines that could be used to help them design student projects and activities for site visits. These pre-prepared activity guidelines can help teachers open up conversations with community and workplace partners who may feel some uncertainty or anxiety around having students visit. (See the list of recommended reading for information on cardiovascular diagnosis unit.)

Sometimes, after the more obvious connections, teachers and community partners will need some help in thinking through how a visit can be made both rigorous and relevant. Often, these conversations can be jump-started by looking for two things:

1. **What broad skills are needed to succeed in this setting?** What basic communication skills are needed? How do workers use resources, technology, and/or information systems? How can these skills also be used and reinforced in the classroom? (A source that describes the broad, transferable skills that employers want is the report from the Secretary's Commission on Achieving Necessary Skills, or SCANS. For a refined treatment of cross-functional skills and connections back to the classroom, see the Applied Learning Standards developed by the National Center on Education and the Economy. Both sources are in the list of recommended reading.)
2. **How does the work here connect with other departments, organizations, or entities?** That is, are there "other aspects" of the work beyond the primary duties performed within the area being explored, that workers need to succeed? For example, in a hospital, many health care providers need to interact with financial or insurance staff. Or, in a manufacturing plant, production teams may work closely with designers and/or marketers at various points through the process.

A word on the relation between student employment and project-based learning: While many good ideas for projects can stem from paid work placements that students may be undertaking, teachers do not necessarily need to have students working for pay at particular worksites to develop good, quality projects. They can often look to the community around them for ideas as well. Joan Schoendecker, a biology teacher in Minneapolis, walked right outside her school and decided to make use of the nearby lake. She asked her students to test the lake water and compare the levels of nitrates and phosphates to the drinking water in the school. Often, such a process leads teachers to work with community partners (like a public health agency or university) that may not provide paid employment opportunities, but can still serve as resources, coaches, and experts to serve on assessment panels.

Designing Classroom and Community Activities

At some point, project partners need to determine not only the actual activities that students will undertake in the classroom and the community, but who, in fact, will determine those activities. More specifically, the teachers and community partners need to decide how much freedom students will have to choose their *own* activities.

As noted earlier, a structural dimension—in this case, establishment of criteria for a project—does not specify which way is "better." Some projects are best designed in advance, with the help of community partners, so that certain activities (e.g., a visit to a cancer ward) are well-structured and conducted appropriately. Other projects allow for significant creativity, and self-determination, on the part of your students. Each teacher has to draw their own line.

Activities Determined by the Teacher and Community Partner

By this point in the project-generation process, even strict "scientific approach" disciples probably have "skipped ahead" and envisioned a few activities that students could do to answer the central question and meet the identified standards! Now is the time to brainstorm a world of possibilities.

Conducting a brainstorming session from the start with other teachers or community partner(s) is an excellent way to begin making key connections between disciplines, or between the classroom and community. Without evaluating ideas, just let them spill out and write them down all at once. The activities can be small, half-day affairs; and they can be large, month-long mini-projects. The group is likely to come up with activities that require significant logistical arrangements; but that should be saved for later.

After a half hour or so brainstorming, there may be two or three of the ideas that the group seems most enthusiastic about, and which should spur a discussion around three questions: What logistical arrangements are necessary to make it work? What resources are necessary? Who will take the next step toward getting those resources/arrangements settled?

It may take time, after the initial session is over, to follow-up on these ideas. Certain activities may come into place more quickly than others. The "big event" that everyone was enthusiastic about during brainstorming may have to wait a semester, or year. Patience and persistence are key. And of course, don't forget that students themselves can be resources and conduct some of the legwork.

Activities Determined by Students

There are at least three advantages to having students determine some portion of their own activities. First, it gives them a richer learning opportunity when they must depend on their own skills and imagination to complete a rigorous, long-term project. Second, it helps to assure authenticity by since students will steer the investigation in ways that are relevant to their own interests. Third, it gives the teacher additional hands and minds to bring in resources and get certain logistics—for example, writing a proposal or work plan—done more quickly.

The best way to support student learning for a project is to follow the *scaffolding guidelines* in the previous section. By going through the checklist of questions, teachers can set up a series of points where students can take control of their own learning. In addition, when students write a proposal or work plan for the project, teachers can think through how to work with them to reach final project goals. To help students write proposals, teachers can develop templates or frameworks that specify things that should be included, such as:[10]

- the central *theme* (including title) of the project;
- the *goals* of the project;
- the *partners* involved in the project;
- how the project will *benefit* the community;
- the *timeline* for the project, including completion date and milestones;
- sources of information or skills *required* for the project;
- skills and information student *will learn* in the classroom and community; and
- how the student will be *assessed* during, and at the end of, the project.

Having students write such material themselves makes clear their accountability, and invests them personally in the process. The last point, how students will be assessed, can be the most rewarding: by giving students some control (within reasonable parameters) over how they will be evaluated, teachers give them the chance to set and explore their own limits—something everyone has to do eventually in life. Giving them guidance in

[10] Adapted from Northwest Regional Education Laboratories 1998.

establishing their own criteria, and supporting them in meeting those criteria throughout the project, allows them to practice this important journey in a safe environment.

Developing Assessment Mechanisms

Beyond the treatment of assessment in the "Six A's" section, a few other suggestions have been advanced by the teachers and experts we've met over time.

First, remember that learning is a process that requires continuous improvement. That is why the word *assess*, which comes from the Latin for "to sit alongside," is appropriate to use when looking at the quality of student work. Teachers can assist students in improving their work by "sitting alongside them" throughout the project, providing feedback at critical points, rather than simply evaluating work with a single, final grade.

There are many different ways of determining whether or not students have met their project goals. Authentic assessment will refine or upgrade skills that can be used in school and in the community. Here are some different types of evaluation teachers and students can choose:[11]

Student self-evaluation:	A formal, comprehensive evaluation (written or oral) of the project and the project process.
Teacher-based evaluation:	Teacher uses assessment tools such as rubrics, scoring guides, paper and pencil tests, research papers, and/or content standards to evaluate student achievement through the project.
Portfolio:	Collect samples of work throughout the project process to demonstrate mastery of specific skills.
Panels of community members:	Participating employers, coaches and other interested members of the community evaluate the project from the perspective of the "real world" outside of school. A student can present the project to them in a variety of ways such as presentation, demonstration, or written report.

There are probably as many ways to assess student work as there are students, and teachers. Here are some other suggestions from practitioners with whom JFF has worked:

Don Brodnansky, a science teacher at Encina High School in California, likes to give his students an opportunity to do peer evaluations, especially when his projects require group work. By giving students the opportunity to evaluate each other's work, he ensures that they will reflect upon whether everyone involved is contributing his or her fair share.

Students can also evaluate themselves by watching presentations they've given that have been videotaped. Joan Schoendecker, a teacher in Minneapolis, likes to have peers assess each other using this approach. (She stresses to her students that criticism should be positive and constructive.)

Finally, students can also provide feedback to the teacher once the project is complete about ways in which the process can be improved. Ultimately, assessment is not an end point but an opportunity to refine a project and improve student learning.

[11] Adapted from Northwest Regional Education Laboratories 1996.

III. Project Summaries

Notes on the Purpose of This Section

This section contains summaries and analyses of six projects to assist you in contextualizing the concepts of structural dimensions, essential (quality) elements, and scaffolding. Each summary includes a brief overview of the background, content, and process of the project; and then a brief "run-through" using the Project Analysis template (see the Appendix).

Each project relates to one of three different fields of inquiry in health care: *product analysis* (which, at more sophisticated levels, would lead to design and production); *policy analysis*, and *clinical studies*. We have tried to supply two of each. Because the three fields are not mutually exclusive; there is some overlap in several of the projects. (For example, the Oakland project has elements of both clinical study and policy analysis.)

For the sake of clarity, please note the following:

- **All of the projects upon which these summaries are based have been used, in some way, in a real classroom.** Wherever possible, the teachers, community partners, and/or national experts and organizations responsible for the project content have been credited. Please refer to the list of recommended reading for more information on certain sources.
- **Each summary has adapted the project as implemented.** For consistency across projects and ease in reading, to show possible alternative directions of a project, or to highlight key quality elements that otherwise may have remained hidden, some small changes may have been made.
- **The goal here is illustration, not evaluation.** We offer these frameworks in a positive spirit. All of the six following projects measure up well against the "Six A's." In the areas where we indicate room for refinement, we seek to illustrate how to conduct an honest assessment of project work and where untapped potential may lie.

Product Analysis: Jar Openers for People with Disabilities

Shady Hill Middle School, Cambridge, MA [12]

Background to the Project

> Technology is a field of study that involves the application of knowledge, resources, materials, tools, and information in designing, producing, and using products, structures (physical and social), and systems to extend human capability to control and modify natural and human-made environments. Technology education...designed to teach understanding and competence in technology and to assess the appropriateness of technological actions...leads to technologically literate citizens, and youth able to consider a wide range of careers in the high-performance workplace as scientists, mathematicians, engineers, engineering technologists, and technicians.[13]

As defined here, technology education entails much more than using computers in the classroom or training students in the technical skills needed to earn a living. It involves students in designing, building, and evaluating real artifacts. In this project, students at a private middle school examine contrasting designs for a simple tool—the jar opener. They examine how variations in the design of this tool make some models more suitable, and others less suitable, for users who have particular physical disabilities.

[12] Adapted from Raizen et al. 1995.

[13] National Science Foundation 1995.

Project Implementation

This technology education unit begins with a trip to a local Rehabilitation Center, where the middle school students meet people who are recovering from serious car accidents, or who are learning to cope with life as paraplegics. They also meet several elderly people with conditions such as severe arthritis and joint problems.

In their social studies class back at school, the students discuss the meanings of words like "handicap" and "disability," and learn about the historical changes that people with disabilities have fought for an won over the last three decades. They also study recent newspaper clippings about government cutbacks, and find out how much work the disability advocacy groups need to do in order to sustain fundraising efforts.

In their life science classes, they study how the human muscular-skeletal system works, how the bones are articulated at the joints, how the muscles contract, and how the bones, tendons, and muscles work together when we walk, catch a ball, or use a tool. Each pair of students chooses a particular disability to study. Through library research and discussion with their teacher, they gain expertise in relation to the chosen disability. Each pair of students then writes an interview script, and uses this script to interview a patient during a second visit to the Rehabilitation Center.

The technology education teacher follows this field experience in life science with a product analysis exercise. He presents several jar openers, and asks the students to find out which one of them is "the best."

Of course, there is no single answer to this question, since the answer depends on who the jar opener is for and what kind of a disability that person has. As in life science, students pair up and choose a particular physical disability to study. This time, they focus on disabilities that either affect the overall strength of the patient, or on those that affect the arms, hands, and shoulders specifically.

In order to find out which jar opener is best for a person with a particular disability, the students first of all need to create a list of disabilities relevant to the study. This is done by revisiting the work they had already completed in their life science class. Here is the list of disabilities one group of students developed together (they left out disabilities that only affect the patient's legs and feet, but included conditions that lead to general weakness).

Disabilities that Make It Hard to Open a Jar

arthritis	Dupytren's contracture
arm amputation	carpal tunnel syndrome
muscular dystrophy	bursitis or tendonitis

The technology teacher coaches his students through a discussion, in which they have to figure out what to do in order to answer the question, "Which jar opener is best?" Drawing on what they had learned in both science and technology education classes, they typically decide they should design and carry out an experiment to determine the answer.

The idea is to identify people with the selected disabilities and then ask them to try using the four different jar openers. Students are to observe what happened, ask the users what seemed to work least painfully for them, and draw conclusions. But this leaves several issues unresolved: How could you make sure that the task was the same each time? Even if the class settled on a "standard jar", how could you adjust it each time so that the lid was exactly as tight as it had been last time? And how many people should carry out the experiment? To produce generalizable results, the students need to use several trials—but how many, exactly?

After the class discusses these questions, technology teacher invites a product evaluation engineer to come visit. Then, to guide the work they intended to do, the students (with coaching) come up with the following essential questions:

1. What standards does a product-evaluation engineer use in conducting experiments that determine which design is best for a particular purpose?
2. Applying these standards, which jar opener is the best one for people who have one of the six disabilities listed above?
3. Why is this the best choice for this disability group? (The answer should explain *how* the particular design compensates for the problems created by that disability.)

After answering the first question, students explore the second and third questions for each of the six disabilities in turn.

Some of the preparation for the investigation that followed has already been carried out in life science classes, since the students already know about the six disabilities they were investigating. However, they need to understand these disabilities in greater depth for their technology education investigation, so over the next two weeks students read library materials, search the Internet, and obtain and read copies of the brochures often given to patients who have each of these disabilities.

In the meantime, the product-evaluation engineer visits the class. She helps the students develop a strategy for recalibrating the tightness of the jar lid at the end of each trial so that it would be exactly as tight as it had been at the start of the trial. The students typically work in groups of four (six groups, one for each disability), so the engineer suggests that each student should find two people with whom to conduct the experiment—meaning eight trials need to be conducted for each disability.

Some students had relatives who had the disability they had chosen to study. To help find more potential subjects, the teacher arranges for the students to visit the Rehabilitation Center for a third time and conduct trials with the patients. The five groups of students work independently during the testing phase, but when they gather their data, they all enter it into one spreadsheet. This makes it easy to see which jar openers best suited people with different disabilities.

Early in the unit, the technology teacher provides the students with his framework for assessment. He explains each of the criteria and discusses them to make sure students understand them. Students are expected to:

- show that they are capable of designing and carrying out an investigation into the strengths and weaknesses of a particular designed product;
- demonstrate an understanding of the how commonly used devices and processes operate;
- develop and demonstrate the personal skills necessary for working effectively with other people; and
- demonstrate the ability to communicate the results of an investigation to and expert audience as well as to non-experts.

He leaves other aspects of the assessment process open for negotiation. The students often suggest that there are several ways to communicate the results of their work. Some students wanted to create an advertising poster for "the best jar opener". Others wanted to write a technical memo to therapists who advise the patients, explaining the results of all six experiments conducted by their class. Others wanted to produce a short video that demonstrated what problems each groups of patients had, and why one particular jar opener was better for most of them. All the students agreed that they should invite therapists from the Rehabilitation Center and the product-evaluation engineer to come to the school and provide feedback on their final products.

Quick Project Analysis

Project Name: *Product Analysis: Jar Openers for People with Disabilities*

I. Dimensions of Quality Project-Based Learning

Group Size: students work in groups of four.

Whole class does same project together	Class breaks into small teams, each doing a project ▼	Each individual in the class does his/her own project

Method for Arriving at Project Structures and Topics: largely determined by teacher, with some choice.

Assigned by teacher	Negotiated between student & teacher within constraints ▼	Negotiated between student & teacher without constraints

Duration: five weeks.

Several days	Several weeks ▼	Full semester or year

Integration of Subjects: course work in three different courses (social studies, life science, technology ed.)

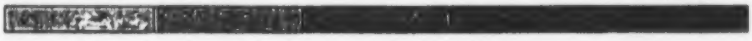
Involves one subject area	Integrates two subject areas	Integrates more than two subject areas ▼

II. The "Six A's" of Quality Project-Based Learning

AUTHENTICITY	IN THIS PROJECT
1. Does the project emanate from a problem or question that has meaning to the student?	1. Most students have relatives with the disabilities studied here.
2. Is it a problem or question that might actually be tackled by an adult at work or in the community?	2. Rehabilitation therapists, and those suffering from disabilities, deal with these issues every day.
3. Does it provide opportunities to create or produce something that has personal and/or social value?	3. Students produce brochures, analyses or advice on a task that is key to the independence of people with disabilities.

Authenticity overall:

directly & completely



ACADEMIC RIGOR	IN THIS PROJECT
1. Does the project lead students to acquire and apply knowledge related to one or more discipline or content area?	1. Students deepen understanding of muscular-skeletal system and how scientific understanding and technology come together to solve problems.
2. Does it challenge students to use methods of inquiry central to one or more disciplines?	2. Students carry out an empirical investigation of commercial products, and learn importance of acceptable standards of evidence.
3. Do students develop higher-order thinking skills and habits of mind?	3. Students think through issues involved in designing an experiment, gathering research, and presenting and organizing data.

Academic rigor overall:

directly & completely

APPLIED LEARNING	IN THIS PROJECT
1. Are students solving a semi-structured problem, grounded in life and work in the world beyond school?	1. Students determine the relative usefulness of jar openers for different disabilities. They also design a brochure, role-play a patient interview, or stage a lecture.
2. Does the work require students to develop organizational and self-management skills?	2. This is a multi-step project, requiring middle school students to be well-organized.
3. Does the project lead students to acquire and use competencies expected in high performance work organizations (e.g. teamwork, problem-solving, appropriate use of technology, communications)?	3. Students do their work in teams. They have to arrange to conduct experimental trials with adults and use information technologies. All the data gathered by the different individuals are entered into a common spreadsheet.

Applied learning overall:

directly & completely

ACTIVE EXPLORATION	IN THIS PROJECT
1. Do students spend significant amounts of time doing field-based work on the project?	1. There are three visits to the Rehabilitation center and two experimental trials with adults.
2. Does it require students to engage in real investigation, using a variety of methods, media and sources?	2. Students do library research as well as experimental trials and analysis
3. Are students expected to communicate what they are learning through presentations?	3. Presentations and role plays are part of the assessment.

Active exploration overall:

directly & completely

ADULT RELATIONSHIPS	IN THIS PROJECT
1. Do students meet and observe adults with relevant expertise and experience?	1. Every student carries out trials of the jar opening experiment with two different adults. During the life science part, they visit Rehabilitation center and interview therapists
2. Do students work closely with and get to know at least one adult?	2. The interviews do not create a relationship; more could be done here.
3. Do the adults collaborate with one another and students on the design and assessment of project work?	3. There is a great deal of teacher-student collaboration; experts do help with the final assessment.

Adult relationships overall:

pretty well, with gaps

ASSESSMENT	IN THIS PROJECT
1. Will there be opportunities for regular assessment of student work through a range of methods (e.g., exhibitions, portfolios)?	1. While regular assessment does not happen too frequently, a range of methods is employed.
2. Do students reflect on their learning, using clear project criteria that they helped to set?	2. This could happen more, depending on the age/maturity of the students in question. The teacher sets most of the criteria in advance.
3. Are adults from outside the classroom involved in the assessment of the work?	3. Adults visit the school at the end of the project to provide students with feedback.

Assessment overall:

strong in most aspects

III. Scaffolding

1. Explicit Expectations and Criteria.

✔ Are there clear guidelines for students to use in planning their project work?
✔ Do students know how and when their work will be assessed?
☐ Were students involved in the establishment of criteria for the assessment?

Clear expectations up front were a major factor in the success of this project. The technology teacher pushed the envelope of what middle school students, despite their age, can discuss and accomplish.

2. Resources.

☐ Are students given the opportunity to review exemplars of work other students have done on similar projects?
✔ Do students have a mentor or coach to support the field-based elements of the project?
✔ Do students know how to use and have access to the technology necessary for research/exhibition?

Note that the technology teacher had to convince community members that his middle school students were mature enough to handle interviews on sensitive matters like disabilities.

Rehabilitation center staff and product engineer serve as excellent resources; however, one-on-one relationships aren't structured under this design. The fact that several students knew one or more people with disabilities gave the technology teacher a nice "hidden resource."

Technology used is simple, inexpensive, and elegant.

3. Milestones, Ongoing Assessment, and Continuous Feedback.

☐ Are there check-in points at the completion of each distinct phase of the work?
☐ Are students expected to turn in a series of "deliverables" prior to the final product?
☐ Do students engage in periodic, structured self-assessment of their progress?
☐ Do they receive timely feedback on their works-in-progress from teacher, mentor, and peers?

Write down your next step(s) for addressing these questions:

Check-in points and self-assessment strategies are not clear. A possible next step here would be to set up an outline for "milestones" that included reflection sessions, journal entries, etc. This outline would be put up front to the class in the same excellent manner used to introduce and support the rest of the project.

Product Analysis: Innovative Products

Roosevelt High School, Minneapolis, MN

Background to the Project

This project is taught in a science course at Roosevelt High School in Minneapolis, Minnesota. While the school houses two career "magnet programs"—one in health, another in business—the project does not depend upon direct use of either magnet's career-related activities. The project has been used with Mr. Eddie Turner's ninth grade science students, as well as some older students taking more advanced science courses.

Roosevelt High School is on a trimester system; this project extends through an entire trimester. Students are given one class a week to work on the project as a team; the rest of the work must happen outside of school hours.

Students are given the opportunity to choose an innovative product currently available in the market that represents a technological innovation. (Examples of products that students can analyze include energy-efficient bulbs and chemical handwarmers.) They choose their products for analysis and begin work close to the beginning of the trimester. Broad scientific principles that complement the skills students develop through projects are taught over the course of the trimester's instruction. For example, simple electronic circuitry would be covered in time for students choosing energy-efficient bulbs as a product to build on that knowledge and conduct more intensive research on their own.

As with many projects of this type and duration, there is some tension between the amount of introductory knowledge required to begin, and the teacher's desire to have students discover and learn as much as they can on their own (through the activities of the project). One lever the teacher has at his disposal is the product selection. Students in earlier grades should choose simpler products that do not require as much foundation knowledge in a particular science. Juniors and seniors in a physics class, who perhaps have completed a chemistry course, could be encouraged to choose products that demonstrate some manipulation of chemical properties (e.g., chemical handwarmers), but also require some understanding of physical principles (in this case, heat transfer) before the product can be fully understood.

Project Implementation

This project is best conducted in team format, for at least two reasons: (1) the project requires a substantial amount of work that can often be split into roles for team members; and (2) the teacher can better guide the course (and project) content if she is coping with several, rather than thirty, different product analyses.

To form teams, the teacher can let students self-select or (as Mr. Turner does) can have each student fill out a one-page questionnaire asking students to evaluate which team skills they may or may not have, and then assign students to teams using whatever calculus suits the teacher best (e.g., matching good Internet researchers with good writers, or extroverts with introverts).

Once in teams, students can decide what product they would like to analyze. The teacher provides a list of sample innovative products that students can use as a basis for brainstorming their own ideas. The list is very broad, including chemical handwarmers, low-temperature superconductors, and high-energy/low-calorie foods. (Such a list could also easily include certain medical equipment, cutting-edge drug treatments, etc.) Each team submits a brief proposal for a product analysis, which must be approved by the teacher before proceeding.

At this point, the team divides up responsibilities for research, writing, and presentation. While all students must make weekly journal notes indicating their contributions, progress, and reflections; one student takes overall responsibility for maintaining the team's journal. The journal includes the team's work plan, roles and responsibilities, and record of progress.

Students research their product, and the science behind it, through whatever methods they deem appropriate: materials used (and experiences gained) in class, library texts, the Internet, or their own experimentation. In addition to these methods, the teacher assigns them the task of writing a letter to the company that makes the product they have chosen. The letter (typed in standard business format) asks for information about the history, testing methods, and type of science used in creating the product.

Students have the option of "contracting for" a C (by completing a well-researched report), a B (by completing a well-researched report and a thorough journal), or an A (by completing a well-researched report, a thorough journal, and a presentation to the class). Reports include a bibliography, narrative and graphic description of the product, a clear explanation of the science behind the product, an evaluation of the product's capabilities and quality, and a self-evaluation of the team and its members. The report is evaluated by Mr. Turner with points awarded for meeting criteria established by him in advance.

Presentations to the class are scheduled after the report is complete. Each team that opts to do this gets 20 minutes to present and answer questions while videotaped. Presentations must include an introduction of the team (including roles played) and the product, a showcase of the product and its capabilities, an engaging presentation of the science behind the product, and an analysis of the testing done on the product. The students are evaluated by their peers, as well as the teacher, according to criteria established by Mr. Turner in advance.

Quick Project Analysis

Project Name: *Product Analysis: Innovative Products*

I. Dimensions of Quality Project-Based Learning

Group Size: students work in small teams.

Whole class does same project together	Class breaks into small teams, each doing a project	Each individual in the class does his/her own project

Method for Arriving at Project Structures and Topics: structure set; students have choice approved by teacher.

Assigned by teacher	Negotiated between student & teacher within constraints	Negotiated between student & teacher without constraints

Duration: approximately ten weeks.

Several days	Several weeks	Full semester or year

Integration of Subjects: communication is implicit within the project; two or three sciences may be involved.

Involves one subject area	Integrates two subject areas	Integrates more than two subject areas

II. The "Six A's" of Quality Project-Based Learning

AUTHENTICITY	IN THIS PROJECT
1. Does the project emanate from a problem or question that has meaning to the student?	1. Students analyze products that they see or use on an everyday basis.
2. Is it a problem or question that might actually be tackled by an adult at work or in the community?	2. A product analysis has value to many professionals (e.g., scientists, designers, manufacturers).
3. Does it provide opportunities to create or produce something that has personal and/or social value?	3. Potential customers for certain products may be interested in some analyses, but no clear intention of audience exists yet.

Authenticity overall:

strong in most aspects

ACADEMIC RIGOR	IN THIS PROJECT
1. Does the project lead students to acquire and apply knowledge related to one or more discipline or content area?	1. The major content area is science (may be one or more within that broad discipline). Communications requirements are also central.
2. Does it challenge students to use methods of inquiry central to one or more disciplines?	2. Research methods and analysis of scientific concepts are reinforced and checked through journals.
3. Do students develop higher-order thinking skills and habits of mind?	3. The research report takes substantial effort over the entire trimester.

Academic rigor overall:

directly & completely

APPLIED LEARNING	IN THIS PROJECT
1. Are students solving a semi-structured problem, grounded in life and work in the world beyond school?	2. Students maintain a journal and must follow a timeline and work plan they set for themselves.
2. Does the work require students to develop organizational and self-management skills?	1. Product analyses are often conducted in the process of solving real problems (e.g., to create the "next generation" product).
3. Does the project lead students to acquire and use competencies expected in high performance work organizations (e.g. teamwork, problem-solving, appropriate use of technology, communications)?	3. Teamwork, use of technology, and communications are all critical parts of completing the project and are part of the assessment.

Applied learning overall:

directly & completely

ACTIVE EXPLORATION	IN THIS PROJECT
1. Do students spend significant amounts of time doing field-based work on the project?	1. Some research in the field may be conducted, but little is required beyond traditional research.
2. Does it require students to engage in real investigation, using a variety of methods, media and sources?	2. Students use an array of media (e.g., library, the organization that built the product, Internet).
3. Are students expected to communicate what they are learning through presentations?	3. Those students who "contract for" a high grade must present to the class.

Active exploration overall:

pretty well, with gaps

ADULT RELATIONSHIPS	IN THIS PROJECT
1. Do students meet and observe adults with relevant expertise and experience?	1. Most project teams only write a letter to the product's company, asking for information.
2. Do students work closely with and get to know at least one adult?	2. No.
3. Do the adults collaborate with one another and students on the design and assessment of project work?	3. No.

Adult relationships overall:

a bit, indirectly

ASSESSMENT	IN THIS PROJECT
1. Will there be opportunities for regular assessment of student work through a range of methods (e.g., exhibitions, portfolios)?	1. Students can "contract for" the grade they want, e.g. by opting to do a presentation. Regular assessment points are not specified.
2. Do students reflect on their learning, using clear project criteria that they helped to set?	2. Student reflect through journals; criteria are set by the teacher.
3. Are adults from outside the classroom involved in the assessment of the work?	3. Not as currently implemented, but the potential is high for involvement of businesses whose products are analyzed.

Assessment overall:

pretty well, with gaps

III. Scaffolding

1. Explicit Expectations and Criteria.

✔ Are there clear guidelines for students to use in planning their project work?
✔ Do students know how and when their work will be assessed?
☐ Were students involved in the establishment of criteria for the assessment?

Guidelines are clear, and students know what and when is due for assessment. Future refinements may include allowing students to discuss what criteria they would like to achieve.

2. Resources.

☐ Are students given the opportunity to review exemplars of work other students have done on similar projects?
✔ Do students have a mentor or coach to support the field-based elements of the project?
✔ Do students know how to use and have access to the technology necessary for research/exhibition?

Establishing relationships with nearby employers who do product analyses would open the door to bringing in experts and additional resources for students' learning.

3. Milestones, Ongoing Assessment, and Continuous Feedback.

☐ Are there check-in points at the completion of each distinct phase of the work?
☐ Are students expected to turn in a series of "deliverables" prior to the final product?

- ❑ Do students engage in periodic, structured self-assessment of their progress?
- ❑ Do they receive timely feedback on their works-in-progress from teacher, mentor, and peers?

The journal represents a milestone activity of sorts, and the report is given back once for students to improve it. More structured activities or products can serve as assessment milestones to help students stay on track. This in turn could raise the possibility that every student in the class could "contract for" an A by doing a presentation.

Policy Analysis: Cost/Benefit Analysis of Health Care Models

Encina Health Careers Academy

Background to the Project

Encina High School in Sacramento, California is part of the San Juan Unified School District, serving a largely urban population. Transiency has historically been a significant problem (an estimated 66 percent rate over four years). In its attempts to build a more stable "learning community," Encina has created several academies to focus academically rigorous programs of study.

These academies adopt broad industry clusters—the Arts (performing and visual, as well as graphics and printing), Health Careers, Business Careers, and so on. The Health Careers Academy was the first established at Encina, with a state grant in 1990. As a funded California Partnership Academy, Encina Health Careers Academy has forged strong links with Sutter Community Hospitals, Western Career College, and Mercy Healthcare Sacramento. Core academic courses are supplemented with health-based courses and activities, including medical terminology, community service, and maintenance of a portfolio.

The health care policy environment around Encina High, as in much of the country, is in turmoil. As managed health care enters communities like Sacramento, school-based health clinics, seen in the 1970s and 1980s as a helpful innovation, face difficult challenges. Often, managed health care plans enroll families into preferred provider panels, with no reimbursement allowed for independently provided services, such as those in a school clinic.

As students and their families become enrolled in a bewildering array of health care models, the question arises: "How can health care best continue to be delivered seamlessly at the school site?" Sutter Community Hospitals (SCH, a division of Sutter Health) and Encina Health Careers Academy established a pilot partnership several years ago. The exploration of the above question became an integral part of that partnership.

Project Implementation

Students (mainly seniors) involved with the project are simultaneously enrolled in Economics & U.S. Government, English IV, and Health Technology III. All three of the teachers coordinate their curricula to meet the various skill development needs of the project. For example, the Economics instructor taught an early lesson on research methodology in the social sciences; likewise, the English instructor teaches the proper methods for creating a card bibliography while doing a literature search. Even computer laboratory faculty, though not formally teaching the project as part of their curriculum, make certain to help students access electronic sources of information for research purposes.

Over the course of a year, the class works together to conduct a thorough cost/benefit analysis of the various health care options the local community faced in establishing accessible health care. Research through library and Internet was done, but due to the dearth of established, student-accessible material on a recent social issue like this, the primary method of research is through staff at SCH. The human resources department brokers access to administrators and various department staff. (Students are obligated to schedule and conduct their own interviews; HR simply identifies willing interviewees and sets context at the start.) In addition, students are encouraged to contact the Mayor's Office, the California Department of Health Services, etc. to conduct additional interviews and research.

Friday sessions of the Health Technology course typically serve as "project day" for the class. This time is used to bring in industry representatives, discuss project issues and logistics, and reflect on their learning experience. These regular days, as well as established "biweekly benchmark" deliverables (a bibliography card catalog, on-line search reports, draft versions of problems statement, procedure/methodology, data gathered, conclusions, and recommendations), give the class plenty of opportunity to check their progress and refine their approach. Industry representatives come to campus biweekly as well, to hear the progress reports, make recommendations for improvements, and approve completed work.

As a culminating event, students produce their recommendations as a SWOT (strengths, weaknesses, opportunities, and threats) analysis. Written reports are submitted by each individual student, and the class makes a group oral presentation. SCH Foundation Board members are asked to provide feedback to students at the end of this presentation, around the quality of the work and the validity of the findings. The recommendations from the pilot year ultimately informed the strategic plan of the company in dealing with community-based medical clinics.

Quick Project Analysis

Project Name: *Policy Analysis: Cost/Benefit Analysis of Health Care Models*

I. Dimensions of Quality Project-Based Learning

Group Size: students work together as a whole class, with some work done as teams or individuals.

Whole class does same project together	Class breaks into small teams, each doing a project	Each individual in the class does his/her own project

Method for Arriving at Project Structures and Topics: determined largely in advance by adults, with students.

Assigned by teacher	Negotiated between student & teacher within constraints	Negotiated between student & teacher without constraints

Duration: a whole year.

Several days	Several weeks	Full semester or year

Integration of Subjects: three distinct courses work together on the project: Economics, English, and Health.

Involves one subject area	Integrates two subject areas	Integrates more than two subject areas

II. The "Six A's" of Quality Project-Based Learning

AUTHENTICITY	IN THIS PROJECT
1. Does the project emanate from a problem or question that has meaning to the student?	1. About 85% of the Encina high student population come from families on AFDC support who have a vested interest in proper health care delivery.
2. Is it a problem or question that might actually be tackled by an adult at work or in the community?	2. The emergence of managed care has created a cottage industry of professionals in policy analysis and provision of health care.
3 Does it provide opportunities to create or produce something that has personal and/or social value?	3. Recommendations are presented to, and taken seriously by, the SCH Foundation Board.

Authenticity overall:

directly & completely

ACADEMIC RIGOR	IN THIS PROJECT
1. Does the project lead students to acquire and apply knowledge related to one or more discipline or content area?	1. The project involves work for courses in multiple disciplines (economics, government policy, life science, English).
2. Does it challenge students to use methods of inquiry central to one or more disciplines?	2. The full year duration gives students the opportunity to employ rigorous research methods in conducting a cost-benefit analysis.
3. Do students develop higher-order thinking skills and habits of mind?	3. The analysis students must do to blend complex health care delivery issues with neighborhood social issues does engage habits of mind.

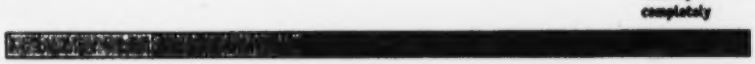
Academic rigor overall:

directly & completely

APPLIED LEARNING	IN THIS PROJECT
1. Are students solving a semi-structured problem, grounded in life and work in the world beyond school?	1. The issue of access to health care is complex and all too real to many people.
2. Does the work require students to develop organizational and self-management skills?	2. The blend of group and individual work gives students ample opportunity to develop complex project management skills.
3. Does the project lead students to acquire and use competencies expected in high performance work organizations (e.g. teamwork, problem-solving, appropriate use of technology, communications)?	3. Working together as a whole class, developing quality recommendations in a presentable format, and grappling with the complex problem at the root of this project all provide these sorts of skills.

Applied learning overall:

directly & completely



ACTIVE EXPLORATION	IN THIS PROJECT
1. Do students spend significant amounts of time doing field-based work on the project?	1. Students conduct a series of interviews, but class time to pursue this project more fully is limited.
2. Does it require students to engage in real investigation, using a variety of methods, media and sources?	2. Students conduct interviews, use the library and Internet, and plan and execute presentations.
3. Are students expected to communicate what they are learning through presentations?	3. In addition to the final report to the Foundation Board, students report on progress biweekly to teachers and industry representatives.

Active exploration overall:

strong in most aspects

ADULT RELATIONSHIPS	IN THIS PROJECT
1. Do students meet and observe adults with relevant expertise and experience?	1. Students do meet with adults who act as consultants to the projects, but they do not necessarily have an opportunity to observe these adults at work.
2. Do students work closely with and get to know at least one adult?	2. SH puts considerable effort into brokering interviews and other exposure to the worksite; however, the project is not structured to create intensive one-on-one student/adult relationships, especially beyond the hospital.
3. Do the adults collaborate with one another and students on the design and assessment of project work?	3. At the outset of the project, students, faculty, and industry representatives met together to design the project and its scope. As part of this process, objectives and outcomes were established that all parties agreed to.

Adult relationships overall:

strong in most aspects

ASSESSMENT	IN THIS PROJECT
1. Will there be opportunities for regular assessment of student work through a range of methods (e.g., exhibitions, portfolios)	1. Milestones using a variety of assessment media are clearly established.
2. Do students reflect on their learning, using clear project criteria that they helped to set?	2. Reflection is one ongoing activity of the project, but students do not appear to engage in regular self-assessment. Student input into criteria for assessment is limited.
3. Are adults from outside the classroom involved in the assessment of the work?	3. Community experts (Foundation Board, etc.) are part of the panel presentations; other industry reps provide ongoing assessment throughout the year.

Assessment overall:

not at all | a bit, indirectly | some aspects present | pretty well, with gaps | strong in most aspects | directly & completely

III. Scaffolding

1. Explicit Expectations and Criteria.

✔ Are there clear guidelines for students to use in planning their project work?
✔ Do students know how and when their work will be assessed?
❑ Were students involved in the establishment of criteria for the assessment?

Expectations and guidelines appear to have been pretty clear from the start. Some students were involved at the very beginning in determining project scope, but criteria for assessment is another area where they could have contributed.

2. Resources.

- ☐ Are students given the opportunity to review exemplars of work other students have done on similar projects?
- ✔ Do students have a mentor or coach to support the field-based elements of the project?
- ✔ Do students know how to use and have access to the technology necessary for research/exhibition?

No work was available the pilot year to base this on, and the accessible research in the managed care field was limited. Given that, an impressive array of resources, in the shape of adult expertise from Sutter Community Hospitals, was made available. Future iterations of this (or other Encina) projects should bolster these resources with more explicit connections to the rest of the community. Finally, partnering with the computer laboratory faculty provides valuable technology support for project research efforts.

3. Milestones, Ongoing Assessment, and Continuous Feedback.

- ☐ Are there check-in points at the completion of each distinct phase of the work?
- ☐ Are students expected to turn in a series of "deliverables" prior to the final product?
- ☐ Do students engage in periodic, structured self-assessment of their progress?
- ☐ Do they receive timely feedback on their works-in-progress from teacher, mentor, and peers?

The bi-weekly benchmark deliverables, with feedback from both teachers and industry representatives, constitute a strong mechanism for ongoing assessment. Some more opportunities for self-assessment would probably work well, too.

Policy Analysis: Teen Clinic Priorities

East Boston High School

Background to the Project

In 1994, the Boston Public Schools (BPS) and the Boston Private Industry Council (BPIC) submitted a joint grant application to the National School-to-Work Office and received a $1.2 million local partnership grant. Jobs for the Future recognized Boston as one of five leading communities in school-to-career, and Boston joined JFF's Benchmark Communities Initiative that same year. BPS, BPIC, and their many local partners have since become leaders in the national STC movement.

East Boston High School was selected as one of four "model" school-to-career high schools within the BPS system. At that time, East Boston had a Travel and Tourism academy (part of the network of the National Academies Foundation), and was looking to expand its STC effort. They began with professional development for the staff, expanding the notion of STC beyond "program" to "educational design." Some of the successes in East Boston's STC system-building efforts include staff supports such as common planning time and targeted (and dramatically increased) professional development opportunities; the institutionalization of a travel and tourism "school-within-a-school" and addition of a health care career pathway; and increased efforts toward data collection and communication with parents and community members.

East Boston High's current school-wide goals describe a vision of a school in which all students participate in and benefit from STC. Throughout their time in East Boston, students will engage in quality project-based learning. The STC staff and others are currently exploring how exactly to make that vision a reality through professional development and classroom experimentation. The "Teen Clinic of the Future" is one example of the emerging use of projects at East Boston.

The Teen Clinic of the Future grew out of a fifteen-year history of shared programming between East Boston High School and the East Boston Neighborhood Health Center (EBNHC). EBNHC provides easily accessible, affordable, primary care and promotes an education-focused, prevention approach to health care. In the last five years, EBNHC has established and staffed a school-based health center at East Boston High School. The two

institutions have also formed the Healthy Partnerships in Education (HoPE) Alliance, an educational youth development program for students interested in health careers.

Project Implementation[14]

The Teen Clinic project was run for the first time last year. All of the HoPE Alliance seniors participated in a field study in which they acted as consultants to the health center. Students were to address the question, "What could be done to improve the health of teenagers in East Boston?" This question had been framed by the teacher and EBNHC partners because it would both matter to the students and was a real question facing the health center. A pediatrician from EBNHC met with the students to make clear the importance of the question to health center and to stress the fact that EBNHC's administration would seriously review the students' work and recommendations. Students then divided into teams to develop "consultant work plans" and to begin to design two aspects of their field studies: a survey of teenagers and research into models of health-care delivery.

The critical question "What could be done to improve the health of teenagers in East Boston?" guides students towards topics that will be of interest to themselves and to the broader community. The project takes a broad view of health with an eye towards prevention strategies—providing room for creativity in topic generation while providing a useful filter in final selection. Topics addressed by students in one year included HIV/AIDS, relationship violence, breast health, teenage sexuality, and alcoholism. While students must all complete the same basic requirements for the Teen Clinic of the Future, this broad range of topics clearly leads to different research experiences and a variety of recommendations made to EBNHC.

Teachers in the Health Career Pathway use the Teen Clinic project as a means to meeting the academic requirements of their courses (as set by the BPS standards) rather than as an "add on." For example, students must write a research paper as part of the project, thus fulfilling one of the English Departments requirements. In carrying out the various research and writing tasks involved in the field study, students make use of time and support in their English, anatomy and physiology, and health professions classes. To complete the project, students must employ the following educational strategies: research, site visits, attending lectures, internship experience, framing critical questions, survey development, portfolio building, and reflection. The Teen Clinic of the Future project has also been designed to develop competencies required of students for completion of the HoPE Alliance program. Specifically, students must address the following components of health care delivery when talking about their particular health issue: health needs assessment, facility design, human resources, technological resources, budget, and marketing/public relations.

CityBuild, a local nonprofit agency, acts as an intermediary to ensure quality in the Teen Clinic projects by connecting students with professionals in the community who share their expertise (in tabulating survey results, writing proposals, preparing audio-visual presentations, etc.) and help students make their work as professional as possible. Assessment of the project is ongoing and multi-dimensional. Students present and defend their Teen Clinic of the Future projects in three public forums. They first present before the Chief Executive Officer and other administrators from EBNHC. Next comes a presentation at Boston City Hall. Finally, the teams present to students, parents, and faculty of East Boston High School.

The Teen Clinic of the Future made an impressive debut as a project over the 1996-97 school year. Students worked on a broad range of interesting topics and created some solid academic work with real connection to the world around them. The teacher team in the health career pathway is taking advantage of professional development around QPBL to reflect upon and refine the Teen Clinic for next year's students. They hope that this process of continuous improvement will serve as a model for future quality project-based learning in East Boston High.

[14] Adapted from *The Harvard Education Letter*, March/April 1997.

Quick Project Analysis

Project Name: *Policy Analysis: Teen Clinic Priorities*

I. Dimensions of Quality Project-Based Learning

Group Size: students work in small teams.

Whole class does same project together	Class breaks into small teams, each doing a project ▼	Each individual in the class does his/her own project

Method for Arriving at Project Structures and Topics: students negotiate their topic within constraints.

Assigned by teacher	Negotiated between student & teacher within constraints ▼	Negotiated between student & teacher without constraints

Duration: several months.

Several days	Several weeks	Full semester or year ▼

Integration of Subjects: three different courses in the Health Career Pathway are involved.

Involves one subject area	Integrates two subject areas	Integrates more than two subject areas ▼

II. The "Six A's" of Quality Project-Based Learning

AUTHENTICITY	IN THIS PROJECT
1. Does the project emanate from a problem or question that has meaning to the student?	1. Topics directly address a health topic of concern to the students.
2. Is it a problem or question that might actually be tackled by an adult at work or in the community?	2. Better teenage health care delivery in East Boston has been of concern to EBNHC, and other community members, for some time.
3. Does it provide opportunities to create or produce something that has personal and/or social value?	3. Presentations are made to three audiences with interest in the work.

Authenticity overall:

directly & completely

ACADEMIC RIGOR	IN THIS PROJECT
1. Does the project lead students to acquire and apply knowledge related to one or more discipline or content area?	1. The project involves work for courses in multiple disciplines (English and anatomy & physiology, as well as health careers).
2. Does it challenge students to use methods of inquiry central to one or more disciplines?	2. Some new skills are required (e.g. survey implementation); however, the project requires more breadth of skills than depth.
3. Do students develop higher-order thinking skills and habits of mind?	3. The analysis students must do to blend clinical health issues with neighborhood social issues does engage habits of mind.

Academic rigor overall:

strong in most aspects

APPLIED LEARNING	IN THIS PROJECT
1. Are students solving a semi-structured problem, grounded in life and work in the world beyond school?	1. The problem was defined and structured by EBNHC and East Boston teachers, and was grounded in life beyond school
2. Does the work require students to develop organizational and self-management skills?	2. It is not clear where students practice these skills in the current structure; some planning work may occur (see box below).
3. Does the project lead students to acquire and use competencies expected in high performance work organizations (e.g. teamwork, problem-solving, appropriate use of technology, communications)?	3. Teamwork and good communications are essential to developing presentations to the various assessment panels. It requires some planning and problem-solving skills, as well.

Applied learning overall:

ACTIVE EXPLORATION	IN THIS PROJECT
1. Do students spend significant amounts of time doing field-based work on the project?	1. In addition to the survey, students should integrate learning from internships; but because topics do not match placements, this varies.
2. Does it require students to engage in real investigation, using a variety of methods, media and sources?	2. Students administer surveys, conduct research, write reports, and plan and execute presentations.
3. Are students expected to communicate what they are learning through presentations?	3. The final presentation includes recommendations to the EBNHC, and others.

Active exploration overall:

ADULT RELATIONSHIPS	IN THIS PROJECT
1. Do students meet and observe adults with relevant expertise and experience?	1. Students do meet with adult consultants to the projects, but they do not necessarily have an opportunity to observe these adults at work.
2. Do students work closely with and get to know at least one adult?	2. CityBuild brokers limited one-on-one contact; the project is not yet structured to create intensive student/adult relationships.
3. Do the adults collaborate with one-another and students on the design and assessment of project work?	3. The HoPE Alliance staff (both school and worksite) created the project in collaboration. Community experts assess panel presentations.

Adult relationships overall:

ASSESSMENT	IN THIS PROJECT
1. Will there be opportunities for regular assessment of student work through a range of methods (e.g., exhibitions, portfolios)?	1. The development of assessment milestones is not yet fully developed; but there are innovative assessment mechanisms being tried.
2. Do students reflect on their learning, using clear project criteria that they helped to set?	2. Reflection is one ongoing activity of the project, but students do not engage in regular self-assessment.
3. Are adults from outside the classroom involved in the assessment of the work?	3. Community experts are part of the panel presentations.

Assessment overall:

III. Scaffolding

1. Explicit Expectations and Criteria.

✔ Are there clear guidelines for students to use in planning their project work?
✔ Do students know how and when their work will be assessed?
❑ Were students involved in the establishment of criteria for the assessment?

The goals of the project are clear, and the requirements required to complete it are well delineated for students. The criteria for assessment may be a bit confusing to some students as assessment happens in many different ways over an extended period of time. Involving them a bit more in the development of some of those criteria may be a good idea.

2. Resources.

❑ Are students given the opportunity to review exemplars of work other students have done on similar projects?
✔ Do students have a mentor or coach to support the field-based elements of the project?
✔ Do students know how to use and have access to the technology necessary for research/exhibition?

Students are provided with adult coaches for aspects of the project and have access to good research materials. The prospects for strengthening this component to involve more one-on-one contact is strong in coming years. In the first year of any project, exemplars of past student work are not available, but next year, students will have access to these as well.

3. Milestones, Ongoing Assessment, and Continuous Feedback.

❑ Are there check-in points at the completion of each distinct phase of the work?
❑ Are students expected to turn in a series of "deliverables" prior to the final product?
❑ Do students engage in periodic, structured self-assessment of their progress?
❑ Do they receive timely feedback on their works-in-progress from teacher, mentor, and peers?

A number of products are required before the final presentation; a clearer articulation of these milestones may benefit students who must cross disciplines to finish activities in different classes. There is also some untapped potential for structured student self-assessment, since they are already involved in reflection activities. The feedback from a broad range of adults is certainly there at the end; but there are fewer mechanisms for ongoing feedback from audiences other than teachers. This will come in time, with stronger relationships with adults from the community (above).

Clinical Studies: Good Blood, Bad Blood

Technology Education Resource Centers

Background to the Project

At the Fenway Middle College High School in Boston, students enter one of three "houses" at the end of ninth grade. Each house is linked with a group of employers who provide students with a broadly-based introduction to an occupational field. Fenway's work-based learning program has been in place for over seven years, but after the initial "teething problems" were sorted out, the teachers wanted to make some improvements in the curriculum. For the Life Science teachers, an important objective was to ensure that the student's hospital activities really supported their science learning.

As a result, the Fenway teachers invited science curriculum developers from TERC's *Working to Learn* project to collaborate with them and with the staff of The Children's Hospital to produce a curriculum unit that:

- connects work-based learning in the hospital with the science standards;
- provides scaffolding for student projects;
- integrates classroom and hospital-based learning; and
- strengthens the quality of the learning that occurs in the hospital setting.

The curriculum unit developed as a result of this process is titled *Working to Learn: Cardiovascular Diagnosis and Physiology.* It is available from TERC (see list of recommended reading). It is used in several high schools across the country, either as part of a work-based learning program, or as part of a regular Life Science course. *Good Blood, Bad Blood* is project that has been adapted from this TERC unit.

CAUTION: Ideally, projects that focus on understanding blood disorders and how these disorders are diagnosed should include a certain amount of direct experience. However, very strict safety precautions need to be followed if you decide to use blood samples for a hands-on student activity.

Project Implementation

Before students develop a project proposal, they need an introduction to the topic. A good place to start is with a visit to a hematology laboratory, where students can find out how blood samples are collected and what techniques might be used to diagnose particular blood disorders. If it is difficult for the students to visit a hospital or blood clinic, the teacher can ask a hematologist to visit the school and show the students materials that indicate how diagnoses are done. After this, each student (or pair of students) should choose one particular blood disorder, study it in detail, carry out an investigation, interview at least one technician or nurse or physician, and finally, develop a product that is presented at a final exhibition. The exhibition should be attended by experts from outside of the school, as well as by the students' own teachers.

As the students define their project topics, they will need to know more about the blood. Your first goal is to help them understand what blood is composed of, what the cells in the blood do, what tests are performed on blood samples, and how blood disorders are diagnosed

Because there are thousands of different blood disorders, it may make sense to focus on one particular family of disorders, such as the anemias. It is better to help students understand a few things in depth, rather than attempting to "cover" a wide range of different blood disorders in a superficial way.

One family of blood problems relates to the oxygen-carrying function, while another relates to immune system deficiencies. Decisions about the focus for student projects might be made through whole-class discussion. In this case, all the students would come to a consensus and the class would choose to focus on one family of blood diseases. This would mean that the class as a whole could produce a comprehensive set of reports on how this family of diseases are diagnosed and what effects they have on health.

An alternative approach is to ask different individuals (or pairs) to study different disorders. While this allows more freedom for students, the demand increases to connect the students with a broader range of adult mentors, and cover more topics.

At Washburn High School in Minneapolis, a Life Science teacher was able to discuss the *Good Blood, Bad Blood* unit with the class, and they decided to study the anemias. The 26 students in the class formed pairs, and each pair developed an essential question that would guide their work. They were told that these questions had to pass two tests. First, the question must allow them to show that they understand what red blood cells do for you and how and why they are sometimes depleted. Second, it must be a question that a medical worker would ask. Here are some examples of the questions they developed.

- How can you tell the difference between a person with anemia and a person who has lost blood because of a hemorrhage?
- How do you know if you have sickle cell anemia?
- What is sickle cell anemia? What effects does it have on your health?
- How do you know if you have leukemia?
- How can leukemia be treated, and how likely is it that it will be fatal?

The teacher agreed to find a technician, a nurse, or a physician that each pair of students could interview. First, the students were required to prepare their interview questions. To do this, they had to use library materials, search the Internet, and obtain copies of the brochures often given to patients who have some form of anemia. Two weeks was allowed for this research: when a pair thought they were ready, they handed their draft interview questions to their teacher, and also listed the resources they had used on a separate page.

The teacher worked with each pair to polish their questions, making them as clear as possible. Everyone in the class agreed that there was one additional requirement each pair of students should pass before doing their interview. Doctors, nurses and technicians speak a special language: the students knew they had to understand and recognize the key terms they were likely to meet. They made a list of these terms, then practiced together, pronouncing the words and giving their meanings. Some students had a relative or a close friend who had the disease they had chosen to study. These pairs arranged an interview with this person, as well.

The teacher had provided students with a "framework for assessment" early in the project. In this framework, she explained the criteria that would be used to judge student work, and justified her decisions. Her content objective was that the students would be required to show that they understood the key functions of the blood, including the role of red blood cells (RBCs), what a normal RBC count means, how quantity of RBCs can be depleted, and what the consequences are for a person's health. Equally important, students should show that they can locate information in reference books, compact disks, and computer databases, and can use and correctly interpret relational terms such as if ... then ..., and, or, correlates with, and causes. The teacher also intended to assess Applied Learning skills. Every student was expected to communicate clearly when they presented their final report, show appropriate self-management skills when they planned and carried out their investigation, and show that they could work smoothly with others, especially in relation to their interview with the nurse of technician.

Other aspects of the assessment process were open for negotiation. The students came up with three ways they could carry out the criteria laid down in their teacher's "framework for assessment." Some students wanted to prepare a pamphlet for teenagers that would explain how to avoid getting blood disorders such as iron-deficiency anemia. Others wanted

to role-play a counseling session in which they explained to a teenager and her parents that she had leukemia, how they were sure of the diagnosis, what course of treatment they suggested, and why they were cautiously optimistic about the likely results. The third group wanted to present their chosen disease by presenting a clinical demonstration or by following the model of a well illustrated lecture to nurses in a training program.

Quick Project Analysis

Project Name: *Clinical Studies: Good Blood, Bad Blood*

I. Dimensions of Quality Project-Based Learning

Group Size: students work in pairs.

Whole class does same project together	Class breaks into small teams, each doing a project	Each individual in the class does his/her own project

Method for Arriving at Project Structures and Topics: topics are negotiated within broad constraints.

Assigned by teacher	Negotiated between student & teacher within constraints	Negotiated between student & teacher without constraints

Duration: approximately three weeks.

Several days	Several weeks	Full semester or year

Integration of Subjects: the life science course makes implicit use of communications skills.

Involves one subject area	Integrates two subject areas	Integrates more than two subject areas

II. The "Six A's" of Quality Project-Based Learning

AUTHENTICITY	IN THIS PROJECT
1. Does the project emanate from a problem or question that has meaning to the student?	1. Most students are interested in blood: authenticity is increased by visit to Hematology Lab
2. Is it a problem or question that might actually be tackled by an adult at work or in the community?	2. Health care professionals working with blood tackle these issues all the time.
3. Does it provide opportunities to create or produce something that has personal and/or social value?	3. An analysis of blood is generally useful, personally and socially. So are the products (e.g., pamphlets) that students produce.

Authenticity overall:

directly & completely

ACADEMIC RIGOR	IN THIS PROJECT
1. Does the project lead students to acquire and apply knowledge related to one or more discipline or content area?	1. The major content area is life science, but the communications requirements are very important; these represent another discipline area.
2. Does it challenge students to use methods of inquiry central to one or more disciplines?	2. Both teacher and workplace supervisor need to ensure that students are not just collecting and regurgitating basic information about the disease they have chosen
3. Do students develop higher-order thinking skills and habits of mind?	3. Analysis and persistence needed to produce a useful brochure or product reinforce these skills.

Academic rigor overall:

directly & completely

APPLIED LEARNING	IN THIS PROJECT
1. Are students solving a semi-structured problem, grounded in life and work in the world beyond school?	1. The problem of diagnosing blood disorders is a real one, and the students do a considerable proportion of their work in a hospital setting.
2. Does the work require students to develop organizational and self-management skills?	2. The students write an schedule and conduct interviews, then design a brochure, role-play a patient interview, or stage a lecture.
3. Does the project lead students to acquire and use competencies expected in high performance work organizations (e.g. teamwork, problem-solving, appropriate use of technology, communications)?	3. Effective use of information technologies is an assessment requirement. Students do all their work in pairs. Results are communicated through exhibitions.

Applied learning overall:

directly & completely

ACTIVE EXPLORATION	IN THIS PROJECT
1. Do students spend significant amounts of time doing field-based work on the project?	1. Students do independent research before writing their interview protocol, then interview a technician. Time limitations prevent more.
2. Does it require students to engage in real investigation, using a variety of methods, media and sources?	2. Students use interviews, library research, etc. but have limited time to complete the entire research and presentation preparation.
3. Are students expected to communicate what they are learning through presentations?	3. Presentations are required.

Active exploration overall:

strong in most aspects

ADULT RELATIONSHIPS	IN THIS PROJECT
1. Do students meet and observe adults with relevant expertise and experience?	1. At a minimum, every student interviews at least one medical or paramedical staff member
2. Do students work closely with and get to know at least one adult?	2. Not really. The interviews do not create a relationship. More could be done here.
3. Do the adults collaborate with one another and students on the design and assessment of project work?	3. Teachers and worksite personnel collaborate on design and assessment.

Adult relationships overall:

strong in most aspects

ASSESSMENT	IN THIS PROJECT
1. Will there be opportunities for regular assessment of student work through a range of methods (e.g., exhibitions, portfolios)?	1. A range of methods are used, at regular intervals.
2. Do students reflect on their learning, using clear project criteria that they helped to set?	2. Reflection is not explicit. Because they decide on their own topics, students need to discuss the interpretation of the criteria with their teachers.
3. Are adults from outside the classroom involved in the assessment of the work?	3. The interview is central, and adults from the workplace attend the exhibitions.

Assessment overall:

strong in most aspects

III. Scaffolding

1. Explicit Expectations and Criteria.

✔ Are there clear guidelines for students to use in planning their project work?
✔ Do students know how and when their work will be assessed?
❑ Were students involved in the establishment of criteria for the assessment?

While many parameters are set up front, students mature enough to enter a Hematology lab are probably also mature enough to take more ownership of the criteria for assessment from the start. A discussion of criteria could take place in a whole-class discussion; or, depending on teacher time and student interest, different criteria could be established for each pair's project.

2. Resources.

❑ Are students given the opportunity to review exemplars of work other students have done on similar projects?
✔ Do students have a mentor or coach to support the field-based elements of the project?
✔ Do students know how to use and have access to the technology necessary for research/exhibition?

Resources appear to be well-placed here. This is an excellent project to show students past work, so that they can build from it and create even more in-depth materials and products.

3. Milestones, Ongoing Assessment, and Continuous Feedback.

❑ Are there check-in points at the completion of each distinct phase of the work?
❑ Are students expected to turn in a series of "deliverables" prior to the final product?
❑ Do students engage in periodic, structured self-assessment of their progress?
❑ Do they receive timely feedback on their works-in-progress from teacher, mentor, and peers?

Some more structure for milestones and periodic feedback could be used here, but since the project only lasts three weeks, this would not be difficult. A nice range of feedback sources is already employed.

Clinical Studies: Topics for Health Peer Educators

Oakland Academy of Health & Bioscience[15]

Background to the Project

Housed in Oakland Technical High School, the Oakland Health & Bioscience Academy is one of the California Partnership Academies. The academy's goal has expanded from its

[15] Adapted from Steinberg 1997b.

original mission of reducing dropout rates and preparing disadvantaged youth for postsecondary education and high-skilled careers, to one that is inclusive of all students in their preparation for the world beyond high school. The Health & Bioscience Academy operates as a school within a school for students in grades 10–12, with a few students entering in the ninth grade. Students spend approximately 80 percent of their school day in interrelated academic and lab classes, including English, social studies, science, and math. In all grades, students take non-Health Academy courses (e.g., foreign languages and art) with other Oakland Tech students. For most of their classes, Health Academy students are in three-hour blocks.

The program places heavy emphasis on project-based learning. Students proceed through increasingly complex school-, work-, and community-based projects that also grow in the amount of student self-direction. While in the Health Academy, students progress from doing small, short-term projects under the tutelage of a teacher in a specific course to completing longer-term integrative projects that cross curricular boundaries and draw upon the expertise of employer and community partners. Students are given less direction and fewer work requirements as they advance until they are tackling open-ended projects with more room for student choice and creativity. Finally, the emphasis of the projects and their assessment shifts from the demonstration of knowledge and skills that they have been taught to undertaking projects of personal interest that make a contribution to a broader audience.

Project Implementation

In the eleventh grade, students engage in projects primarily within the physiology class; English and social studies also dovetail several key activities (such as career portfolios). The projects are year-long and contain several milestone deliverables along the way. The year begins with building the knowledge and skills necessary to complete the larger project through smaller research efforts. Then, in small teams, students choose a health issue or problem that interests them. They then submit a project proposal that includes the scope of the problem, their research strategies, and a list of potential resources. After completing the research requirements, each team creates a newsletter on its topic. This newsletter itself is one benchmark in the process, but teams also submit a summary of each member's role in the writing and production of the newsletter. The teams then plan and rehearse presentations that they will give to a real audience affected by their issues. The final benchmark of the project is the actual presentation to a community group. Students are graded on their health education strategy as well as their mastery of the facts of the issue. The project emphasizes the fact that while it is important to develop technical knowledge about aspects of physiology, this knowledge is only useful if it can be used to help people change behaviors to improve their health.

David de Leeuw, the physiology teacher who was central to the launch of this project years ago, has tried to balance providing enough structure to ensure consistency, with allowing for student creativity and individualization. He encourages students to select an issue in which they have some investment and to think carefully about the target audience for their final presentations. Past project topics have included investigating the health effects of vegetarianism and creating AIDS education materials for teenagers. Most importantly, teams must frame their issues and define their projects in such a way that they will create useful health education tools. The requirement that the product be "of use" seems to be very effective in leading students towards good topics.

While the project design allows for great flexibility in terms of topic selection, de Leeuw sets out clear expectations regarding benchmark deliverables for each phase of the work. During the proposal and research phase, teams draw on their basic knowledge about health and the specific issue they have selected to write a description of the scope of the problem, and keep a list of sources that will help them address it. Students also submit individual research notebooks detailing how they used their research time and contributed to their team's project.

The newsletters that teams produce are substantial pieces of work—typically more than the minimum four to six pages. They include (by assessment design) factual pieces on the

health issue, articles detailing one or more controversies related to the issue, and human interest stories. Within these boundaries, students are able to use a great deal of creativity not only in the writing of the articles but also in the illustrations and overall newsletter design. The newsletter is also accompanied by a summary of each team member's role in the writing and production process. If the newsletter is of high enough quality, it may be distributed to its target audience through an existing community agency such as the American Red Cross. Because this project has existed for years, a substantial binder of past newsletters exists to help each new cohort of students learn what is expected of them, and build from what has been done already.

Finally, teams are expected to prepare and deliver a content-rich and engaging presentation to an audience who is affected by the particular issue. For example, a team that studied the effects of tobacco smoking ran anti-smoking workshops for their peers. As with the newsletter, these presentations are graded on their educational impact as well as their demonstration of content mastery.

Adult support for the project extends well beyond the classroom teacher and other Health & Bioscience Academy staff. Students work with outside experts in all but the earliest stages of the project. As the students finish their project proposals, Academy staff recruit an industry coach for each team. The team's project proposal is used to attract at least one expert in the specified problem area. (Over time, the Academy staff—with the ongoing recruitment assistance of University of California at Berkeley, Samuel Merritt College, and Kaiser—have generated a database of likely names and numbers. Students still often add their own contacts, from work supervisors or other adults they know.)

Throughout the remainder of the project, the coach meets with the team to review their research findings, suggest additional areas of research, and help them anticipate questions their audience may ask. When the students move to planning their final presentation, they are helped (in a whole-class setting) by a new set of experts, who specialize in health education.

One of the more recent refinements to this project is the development of clear assessment rubrics for project deliverables. Some of these rubrics are developed by the students themselves (often seniors in the English class), based on previous students' work and using multiple perspectives, combined with peer reflection sessions, to gradually merge and refine rubric definitions.

Quick Project Analysis

Project Name: *Clinical Studies: Topics for Health Peer Educators*

I. Dimensions of Quality Project-Based Learning

Group Size: students work in small teams.

Whole class does same project together	Class breaks into small teams, each doing a project	Each individual in the class does his/her own project

Method for Arriving at Project Structures and Topics: topics are negotiated within broad constraints.

Assigned by teacher	Negotiated between student & teacher within constraints	Negotiated between student & teacher without constraints

Duration: the project spans from half to all of a school year.

Several days	Several weeks	Full semester or year

Integration of Subjects: makes explicit use of activities in Physiology, English, and Social Studies.

Involves one subject area	Integrates two subject areas	Integrates more than two subject areas

II. The "Six A's" of Quality Project-Based Learning

AUTHENTICITY	IN THIS PROJECT
1. Does the project emanate from a problem or question that has meaning to the student?	1. Students choose their own topics and are strongly encouraged to work in areas of personal interest.
2. Is it a problem or question that might actually be tackled by an adult at work or in the community?	2. A major criteria for the topic selection and the various products are their importance to the community and social value.
3. Does it provide opportunities to create or produce something that has personal and/or social value?	3. Both the newsletter and the final presentation must be created for a population effected by the issue.

Authenticity overall:

directly & completely

ACADEMIC RIGOR	IN THIS PROJECT
1. Does the project lead students to acquire and apply knowledge related to one or more discipline or content area?	1. While the project is part of a science course (physiology), students must demonstrate oral and written communication skills.
2. Does it challenge students to use methods of inquiry central to one or more disciplines?	2. Students spend in-depth time exploring principles of life science (as well as historical and social factors) relevant to their issue.
3. Do students develop higher-order thinking skills and habits of mind?	3. Students blend life and social sciences in a way that strongly reinforces good habits of mind.

Academic rigor overall:

directly & completely

APPLIED LEARNING	IN THIS PROJECT
1. Are students solving a semi-structured problem, grounded in life and work in the world beyond school?	1. The problem of how to present health education on a particular issue, so as to change actual behavior, is one faced by health educators.
2. Does the work require students to develop organizational and self-management skills?	2. The complex products require both self-management and teamwork skills.
3. Does the project lead students to acquire and use competencies expected in high performance work organizations (e.g. teamwork, problem-solving, appropriate use of technology, communications)?	3. Teamwork and communications skills are central to the project. Problem-solving and use of technology (especially in the production of the newsletter) are also key.

Applied learning overall:

directly & completely

ACTIVE EXPLORATION	IN THIS PROJECT
1. Do students spend significant amounts of time doing field-based work on the project?	1. The amount of field-based research varies across projects, but all projects require it to some degree.
2. Does it require students to engage in real investigation, using a variety of methods, media and sources?	2. Students use interviews, library research, Internet, etc. in their investigation.
3. Are students expected to communicate what they are learning through presentations?	3. Yes, all students present to community audiences and/or peers.

Active exploration overall:

not at all — strong in most aspects

ADULT RELATIONSHIPS	IN THIS PROJECT
1. Do students meet and observe adults with relevant expertise and experience?	1. Adult coaches participate in the research phase, newsletter production, and presentation planning.
2. Do students work closely with and get to know at least one adult?	2. Students have several meetings with their coaches, but the intensity of the relationships varies across projects.
3. Do the adults collaborate with one another and students on the design and assessment of project work?	3. The classroom teacher serves as the liaison between the various coaches and the students, for design, assessment, etc.

Adult relationships overall:

not at all — directly & completely

ASSESSMENT	IN THIS PROJECT
1. Will there be opportunities for regular assessment of student work through a range of methods (e.g., exhibitions, portfolios)?	1. There are "benchmark deliverables" established for the project.
2. Do students reflect on their learning, using clear project criteria that they helped to set?	2. Students must submit journals describing and reflecting upon their personal contributions to team products.
3. Are adults from outside the classroom involved in the assessment of the work?	3. Adult coaches provide feedback to the classroom teacher.

Assessment overall:

not at all — directly & completely

III. Scaffolding

1. Explicit Expectations and Criteria.

✔ Are there clear guidelines for students to use in planning their project work?
✔ Do students know how and when their work will be assessed?
☐ Were students involved in the establishment of criteria for the assessment?

Write down your next step(s) for addressing these questions:

The guidelines are very clear in this project. By writing their own proposals, students develop ownership of what they will produce. More could be done to assist students in setting their own criteria.

2. Resources.

- ☐ Are students given the opportunity to review exemplars of work other students have done on similar projects?
- ✔ Do students have a mentor or coach to support the field-based elements of the project?
- ✔ Do students know how to use and have access to the technology necessary for research/exhibition?

A binder of project newsletters from past years is used frequently. Coaches are used for both health issue content and presentation skills, and some experimentation is now being done with "on-line" coaches (e.g., professionals at the National Institutes of Health) and student peer coaches (from the technology academy, on computer skills).

3. Milestones, Ongoing Assessment, and Continuous Feedback.

- ☐ Are there check-in points at the completion of each distinct phase of the work?
- ☐ Are students expected to turn in a series of "deliverables" prior to the final product?
- ☐ Do students engage in periodic, structured self-assessment of their progress?
- ☐ Do they receive timely feedback on their works-in-progress from teacher, mentor, and peers?

The project is strong in specifying deliverables and the regularity of check-in points. Students know what is expected of them and what high quality looks like. Feedback is received from teachers, coaches, and peers.

Recommended Reading

The Center for Learning, Technology, and Work. 1995. *Integrating Science and the Workplace: A Curriculum User's Guide.* Boston, MA: The Center for Learning, Technology, and Work, a division of the NETWORK, Inc.

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Appendix: Project Analysis Template

These four pages summarize the elements of quality project-based learning and are meant to serve as an inventory for designing and assessing your own projects. Feel free to copy these pages.

Quick Project Analysis

Project Name: _____

I. Dimensions of Quality Project-Based Learning

Mark the point where the project is likely to fall along the following dimensions:

Group Size

Whole class does same project together	Class breaks into small teams, each doing a project	Each individual in the class does his/her own project

Method for Arriving at Project Structures and Topics

Assigned by teacher	Negotiated between student & teacher within constraints	Negotiated between student & teacher without constraints

Duration

Several days	Several weeks	Full semester or year

Integration of Subjects

Involves one subject area	Integrates two subject areas	Integrates more than two subject areas

II. The "Six A's" of Quality Project-Based Learning

Answer the questions that follow for each of the Six A's. Then, after each set of questions, circle the area of the spectrum that best reflects how well that element is established in the project.

AUTHENTICITY	IN THIS PROJECT
1. Does the project emanate from a problem or question that has meaning to the student?	
2. Is it a problem or question that might actually be tackled by an adult at work or in the community?	
3. Does it provide opportunities to create or produce something that has personal and/or social value?	

Assess overall authenticity by circling the appropriate area:

not at all	a bit, indirectly	some aspects present	pretty well, with gaps	strong in most aspects	directly & completely

ACADEMIC RIGOR	IN THIS PROJECT
1. Does the project lead students to acquire and apply knowledge related to one or more discipline or content area?	
2. Does it challenge students to use methods of inquiry central to one or more disciplines?	
3. Do students develop higher-order thinking skills and habits of mind?	

Assess overall academic rigor by circling the appropriate area:

not at all	a bit, indirectly	some aspects present	pretty well, with gaps	strong in most aspects	directly & completely

APPLIED LEARNING	IN THIS PROJECT
1. Are students solving a semi-structured problem, grounded in life and work in the world beyond school?	
2. Does the work require students to develop organizational and self-management skills?	
3. Does the project lead students to acquire and use competencies expected in high performance work organizations?	

Assess overall applied learning by circling the appropriate area:

not at all	a bit, indirectly	some aspects present	pretty well, with gaps	strong in most aspects	directly & completely

ACTIVE EXPLORATION	IN THIS PROJECT
1. Do students spend significant amounts of time doing field-based work on the project?	
2. Does it require students to engage in real investigation, using a variety of methods, media and sources?	
3. Are students expected to communicate what they are learning through presentations?	

Assess overall active exploration by circling the appropriate area:

not at all	a bit, indirectly	some aspects present	pretty well, with gaps	strong in most aspects	directly & completely

ADULT RELATIONSHIPS	IN THIS PROJECT
1. Do students meet and observe adults with relevant expertise and experience?	
2. Do students work closely with and get to know at least one adult?	
3. Do the adults collaborate with one another and students on the design and assessment of project work?	

Assess overall adult relationships by circling the appropriate area:

not at all	a bit, indirectly	some aspects present	pretty well, with gaps	strong in most aspects	directly & completely

ASSESSMENT	IN THIS PROJECT
1. Will there be opportunities for regular assessment of student work through a range of methods (exhibitions, portfolios)?	
2. Do students reflect on their learning, using clear project criteria that they helped to set?	
3. Are adults from outside the classroom involved in the assessment of the work?	

Assess overall assessment by circling the appropriate area:

not at all	a bit, indirectly	some aspects present	pretty well, with gaps	strong in most aspects	directly & completely

III. Scaffolding

Check the appropriate boxes and describe your next steps for each of the elements of scaffolding:

1. Explicit Expectations and Criteria.

✔ Are there clear guidelines for students to use in planning their project work?
✔ Do students know how and when their work will be assessed?
☐ Were students involved in the establishment of criteria for the assessment?

Next step(s) and notes:

2. Resources.

- ❑ Are students given the opportunity to review exemplars of work other students have done on similar projects?
- ✔ Do students have a mentor or coach to support the field-based elements of the project?
- ✔ Do students know how to use and have access to the technology necessary for research/exhibition?

Next step(s) and notes:

3. Milestones, Ongoing Assessment, and Continuous Feedback.

- ❑ Are there check-in points at the completion of each distinct phase of the work?
- ❑ Are students expected to turn in a series of "deliverables" prior to the final product?
- ❑ Do students engage in periodic, structured self-assessment of their progress?
- ❑ Do they receive timely feedback on their works-in-progress from teacher, mentor, and peers?

Next step(s) and notes:

Notes